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Improved Pump.

The pumping apparatus represented in the engravings has been designed not only to meet the requirements involved in the employment of this class of mechanism, but also to meet in an especial manner the wants of distilleries, breweries, gas work erections, and other establishments where it is necessary to raise comparatively thick and heavy liquids, and also those situations where, as is often the case in the West and South, the water is muddy, and consequently liable to derange the parts of an ordinary pump. The construction of the improved machinery for the purpose indicated, as well as its mode of operation, will be understood from the description, having reference to the cuts, in which fig. 1 is a perspective and fig. 2 a vertical transverse section of the apparatus. It will be noticed that the construction of this pump is radically different from the pumps now in use. The outer shell, A, is a cylinder sufficiently enlarged to admit the cylinder, B (in which the piston travels) within it—thus making a cylinder within a cylinder—and that it projects beyond cylinder B, so as to allow a large opening for the free passage of liquid. The space between the two cylinders is designed for a receiver, in which to allow all gravel and similar substances to settle, keeping them from coming in contact with and injuring the working parts of the pump—and which can be removed through a hand hole. Above the cylinder, A, are two chambers, D, between which is situated a rectangular case, divided into two compartments by a horizontal partition. With the upper compartment communicates the inlet-pipe or passage, F, and with the other compartment communicates the outlet-pipe or passage, indicated in dotted outline at G. The upper compartment has, furthermore, two valves, *c*, opening outward, while the lower compartment is furnished with two similar valves, L, opening inward. Arranged above the case just described is an air receiver, E, which by means of a passage, furnished with valves as hereinafter more fully expressed, communicates with the chambers, D. It should also be mentioned that in addition to the parts above described the pump is fitted with the usual air-chamber, H. As the piston, C, moves in one direction, the water or other liquid from the inlet pipe, F, is forced by the pressure of the atmosphere into the upper compartment of the case, and lifting one of the valves, *c*, passes into the adjacent chamber, D, and that portion of the cylinder B, behind the piston. Any air that may be introduced mechanically with the liquid rises, by its lighter gravity, and passing between a valve, *a*, and the seat below which it is arranged, lifts another valve provided at the upper end of the stem of the valve, *a*, and passes first into the air receiver, E, and then from the latter through an outlet-pipe provided in its top. Should any of the liquid be carried over into the air-vessel, it may either be withdrawn from the bottom of such vessel at appropriate intervals by a stop-cock, or it may be suffered to escape continually therefrom, as may be desired. Simultaneously with the entrance, as just described, of the liquid behind the piston, that in front of the latter, lifting one of the valves L, passes directly to the outlet pipe, the passage of the liquid to the air receiver, when thus subjected to the pressure of the piston, being prevented by the forcing upward of the adjacent valve, *a*, to its seat by the pressure of the liquid. In the reverse movement of the piston the operation is of course the same, the valves raise during one movement of the piston, being closed during the other, and *vice versa*. The air-receiver, E, is only used when valuable liquids are being pumped, so that in case any should pass valves *a* and *b*, it can be secured in the receiver—where water or other liquids of little or no value are being pumped the receiver, E, is not necessary, as the valves will sufficiently prevent its passage. Attention is also called to the construction and arrangement of the valves. The valve seat is a metal block, diamond-shaped, fitted tightly to its place. The inlet-valves, *c*, open into the upright chambers—and the outlet valves, *d*, open outward, into the diamond—a bonnet is bolted on, as shown in fig. 1. To get at the valves it is only necessary to remove the bonnet—and any or all of them can be removed and new ones inserted without disturbing the valve-seat. When necessary, the rest can be taken out and returned without difficulty. Among the advantages claimed for this pump by the inventors may be named the following: The piston being submerged and the liquid always filling the entire pump, no space is afforded for the collection of air, which might otherwise interfere with the proper operation of the parts, and any air that may find its way into the pump rises to the top of this liquid and passes off through the air-receiver, which allows it a free passage, but by means of the valves connected with such receiver closes as soon as the air has passed out, thus separating the air and liquid, so that each has its own outlet, and a continuous stream of the liquid is ejected from the pump. Furthermore, the main or inlet and outlet valves are very easy of access when desired. The parts or passages may be made of sufficient size to obviate any danger of clogging from the introduction of foreign substances, and the space allowed below the level of the cylinder receives any gravel or similar materials that may find their way into the pump, and thus prevents the same from interfering with the action of the apparatus. These pumps are manufactured and sold by Messrs. FRYER BROTHERS, Nos. 8 and 10 Wall street, Rooms No. 43, 45 and 47, New York City, to whom all orders may be addressed.

Fig. 1

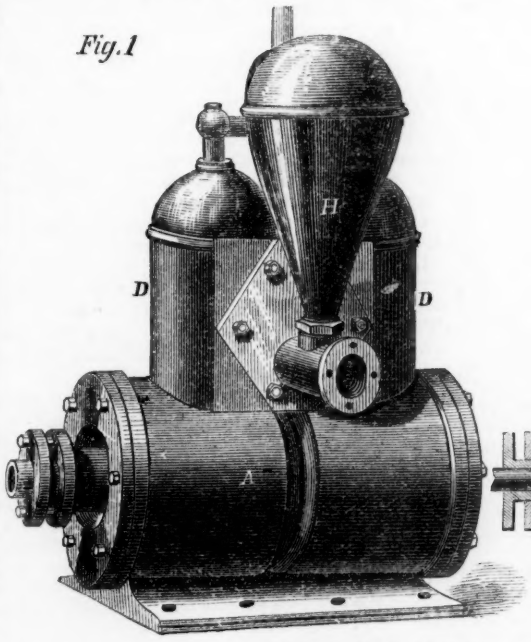
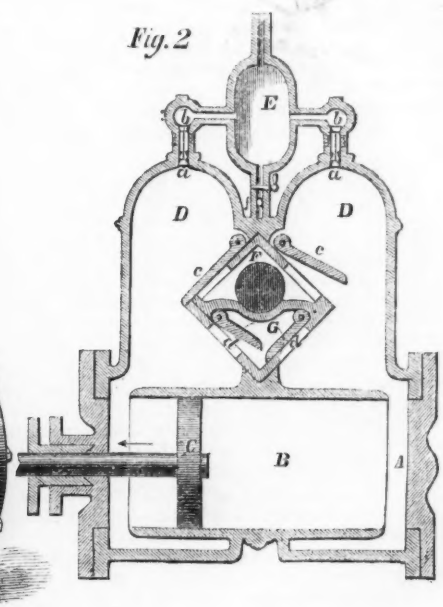


Fig. 2



IMPROVED PUMP.

The Gas Companies and the Board of Health.

In the matter of the application of OSCAR ZOLLIKOFFER, *President of the Metropolitan Gas-Light Company, for the modification of the order No.* 425, *dated July* 14*th*, 1868, *of the Metropolitan Board of Health, concerning the business of Manufacturing Gas, at the foot of West* 42*nd Street.*

At a hearing before the undersigned, D. B. Hasbrouck, held at the office of the Metropolitan Board of Health, No. 301 Mott Street, New York, on the 1st day of August, 1868, in pursuance of the order and notice of the Metropolitan Board of Health, a copy of which is hereto annexed.

By consent of both parties the hearing was ad journed to August 5, 1868, at 10 o'clock A. M. No testimony was offered.

At the adjourned hearing, August 5, 1868, at same place, by consent of both parties a further adjournment was had to August 10, 1868, at 11 o'clock A. M. No testimony was offered.

At a hearing before the undersigned, D. B. Hasbrouck, held at the same place on the 10th of August, 1868.

Oscar Zollicoffer, Pres't Met. Gas Light Company, appeared in person and by *H. C. Van Vorst.*

The *Metropolitan Board of Health*, by *H. C. Allen.*

Form No. 5.

Order No 11.

Suspension of Order and Notice of hearing, under the First Clause of Section 14 of the Metropolitan Health Law, Chapter 74, of Laws of 1867.

OFFICE OF THE METROPOLITAN BOARD OF HEALTH,
No 301 Mott Street,
New York, July 29th, 1868.

This Board having, on the 14th day of July, 1868, made an Order, (being order No 425,) relative to the business of manufacturing gas at the foot of West 42nd St., N. Y., and having declared the same to be a public nuisance, and to the general effect that the business of manufacturing gas (conducted by the Metropolitan Gas Company) at the foot of W. 42nd St., N. Y. be discontinued, except it be conducted by a process of manufacture that will not allow any *deleterious gases* or *odors detrimental to health* to escape into the external air; and the same having, on or about the 15th day of July, 1868, been served upon Oscar Zollicoffer, Pres't Metropolitan Gas Co., being the proper party, and said Oscar Zollicoffer having requested the opportunity to be heard before this Board, which said clause of said section authorizes, the execution of said order is hereby suspended until the further order of this Board.

And notice is hereby given to said Oscar Zollicoffer, who has requested an opportunity for a hearing, that he will be heard, and can present facts and proofs, as said law and regulations of this Board provide, before this Board, at its office as above, on the first day of August, 1868, at 10 o'clock A. M. on that day, or as soon thereafter as said hearing can be had. Said applicant must take notice of the adjournments of this Board, and of its rules and regulations, and of its final order in this matter, and must be prepared to proceed in said matter, at said time and place, and at any subsequent meeting, as the business of said Board will allow; and all without further notice, beyond the service of a copy hereof. Witness the signature of

EMMONS CLARK,
Secretary of the Board of Health.

Apjourned to August 5th, at 10 A. M.

D. B. H.

Adjourned to August 12th, 1861, at 11 A. M.*

Charles F. Chandler, called for the Metropolitan Board of Health, being duly sworn, testifies as follows:

By Mr. Allen:

Q. What is your profession? A. Chemist.

Q. Are you connected with any public institution in this city? A. Yes, sir; I hold the chair of Analytical and Applied Chemistry in the School of Mines of Columbia College.

Q. And also chemist of the Metropolitan Board of Health? A. Yes, sir.

Q. Have you paid special attention to the chemistry of illuminating gas? A. Yes, sir.

Q. From what is illuminating gas prepared? A. Bituminous coal.

Q. What is the composition of Bituminous coal? A. Carbon and hydrogen, with some sulphur and nitrogen, and earthy and silicious impurities which constitute the ash.

Q. How is the gas prepared from the coal? A. By exposing it to a high temperature in retorts of iron or clay.

Q. What are the products of this? A. Coke, tar, ammoniacal liquor and gas.

Q. What becomes of these products? A. The coke remains in the retort; the tar and ammoniacal liquor accumulate in the hydraulic main, and in the condenser and scrubber; the gas passes on to the purifiers.

Q. What is the composition of the gas as it leaves the hydraulic main you speak of? A. It consists chiefly of marsh gas, carbonic oxide, and hydrogen, which are the non-illuminating combustible constituents; of olefiant gas and several other hydro carbon gases and vapors which are the illuminating constituents—sulphuretted hydrogen, carbonic acid ammonia, cyanogen, sulpho-cyanogen, nitrogen; (I believe those are the most important ones;) bisulphide of carban, aqueous vapors; this last group of eight constituents constitute the useless or injurious impurities; I did not mention the hydro-carbons individually; there are a dozen or twenty which I group.

Q. Have you ever visited the works of the Metropolitan Gas Company? A. Yes.

Q. What process do they use there for purifying the gas? A. The dry lime process.

Q. What is the composition of the lime after it has acted upon the gas? A. It consists essentially of sulphide of calcium, carbonate of lime, hydrate of lime: and contains small quantities of ammonia, cyanide of calcium, sulpho-cyanide of calcium.

Q. Is that all? A. Except a little tarry matter; may be minute traces of other things, but those are the essential constituents.

Q. What occurs when this spent or useless lime is exposed to the air? A. The ammonia absorbs carbonic acid, forming carbonate of ammonia; the carbonate of ammonia decomposes the sulphide of calcium, forming the sulphide of ammonium, which is evolved; Carbonic acid decomposes sulphide of calcium, liberating sulphuretted hydrogen; oxygen is absorbed with the evolution of heat, and the formation of hyposulphite, sulphite and sulphate of lime. These are the more important reactions.

Q. What is the nature of this gas as to its offensiveness, when evolved in the air? A. The sulphuretted hydrogen and sulphide of ammonium are the predominant constituents of the disagreeable odors evolved by the lime refuse.

Q. The fact is, they produce a disagreeable odor? A. They have a disagreeable odor.

Q. Is this disagreeable odor equally perceptible in all kinds of weather? A. No; in dry, clear weather, the odors rise rapidly in the air, but in damp, heavy weather, particularly with the wind favorable, the odor will diffuse itself throughout the neighborhood.

Q. Would this lime be equally offensive, if more lime were used for the same quantity of gas? A. It would make a little difference, perhaps, but the odor is not due to over saturation; in fact, the refuse contains fifteen or twenty per cent. of unchanged hydrate of lime; consequently it is never over-saturated.

Q. Is it possible to prevent the escape of the foul odors from the dry lime process? A. I think not.

Q. We come to another point: Is it necessary to employ the dry lime process for the purification of gas? A. I think not; I know it is not.

Q. What is the wet lime process? That is a process in which the lime is mixed with a large quantity of water, to the consistency of cream, and the gas obliged to bubble through it; the chemical reactions are the same as in the dry lime process.

Q. Is that in general use? A. No; I have seen it in use in some places, but I believe it is generally abandoned; it is sometimes used with the iron process, for the more complete removal of carbonic acid, after the sulphur has been removed by oxide of iron.

Q. What is Laming's process? A. It consists in using a mixture of the hydrated sesquioxide of iron, sulphate of lime, hydrate of lime and sawdust, or some other porous material; the mixture consists of dry slacked lime and sawdust in equal quantities, to which is added, for every pound of lime, one pound of sulphate of iron, (copperas) dissolved in water. The mixture is exposed to the air for twenty-four hours, to oxidize the protoxide of iron to the sesquioxide. It then consists of hydrated sesquioxide of iron, sulphate of iron, hydrate of lime, sawdust.

In the place of copperas, double the weight of sesquichloride of iron is sometimes used, when the mixture consists of hydrated sesquioxide of iron, chloride of calcium, hydrate of lime, sawdust.

Q. What are the disadvantages of Laming's process? A. It is said to be somewhat more expensive in some cities than the dry lime process; while in other places it is said to be much cheaper.

Q. Has it any advantages? A. It has been claimed by some that the gas suffers slightly in illuminating power, though even if this be true, it could be easily remddied by the use of a larger proportion of cannel coal, or the use of small quantities of Albert or Boghead coal; it is stated, however, by others, that no such loss in illuminating power occurs; Unruh, in Magdeburg, where the proces is employed, found that the illuminating power was not all diminished, while the sulphuretted hydrogen was entirely, and the carbonic acid almost entirely removed the process being much cheaper than dry lime; it has also been stated that it fails to remove the carbonic acid completely; but should this difficulty occur it can be easily remedied by the use of a little lime after the iron mixture; those are the answers to the disadvantages.

Q. Has it any advantages? A. The gas passes more readily through the mass—the mixture may be used over and over again—and when it finally becomes useless for purifying gas, may be sold for the extraction of the sulphur it contains: but the most important advantage consists in the entire suppression of the disagreeable smell which is evolved from the dry lime refuse.

Q. Will you describe the iron ore process? A. In the iron ore process, brown hematite or bog iron ore, in coarse powder, is employed to absorb the sulphuretted hydrogen; this substance is an impure hydrated sesquioxide of iron, and has the same action on the sulphuretted hydrogen of the gas as has already been mentioned in describing Laming's process; I am informed that at the new gas works in Berlin, a bog ore from Silesia is employed; it is dried, pulverized, sifted, and placed in the purifier either alone or mixed with sawdust; it is cheaper than Laming's mixture; it is regenerated slower at first, but more rapidly afterwards; and its action on the gas increases with use; at Hanover the iron ore of Lunenberg mixed with spent tan-bark is employed.

Q. Is this process in use in this country? A. With slight modifications it is employed at the New York Gas Company's Works on East 21st street.

Q. What are the modifications employed at the New York Gas Works? H. Iron ore on Staten Island is mixed with sufficient quantity of iron turnings, filings, or borings, to increase the amount of iron to eighty per cent; the mixture is moistened with ammonia water and exposed to the air, when the metallic iron is rapidly oxydized; when dry it is mixed with about five per cent. of charcoal powder; it is then slightly moistened with water and placed in the purifiers in a single layer two feet deep; when the mixture ceases to act upon the gas it is withdrawn and exposed to the air, when it is rapidly regenerated, and may be used over and over again; the mixture now in use at the works has been in use since April 21st.

Q. Is that process effective as a purifier? A. I cannot say of my own knowledge, but have heard no complaints with regard to the quality of the gas.

Q. Does the mixture evolve any disagreeable odor after it has been used? A. I have noticed none; I was there while the material was being taken out of the purifiers and shoveled over; I detected no odor of sulphide of ammonium or sulphuretted hydrogen.

Q. Is it more expensive than the dry lime process? A. I should think not. The ore costs five dollars a ton, and is used again and again, while lime is used but once. I was informed that the New York Company spent from $18,000 to $19,000 a year for lime by the old process.

Q. Is this process used by the New York Company patented? A. The combination of ore, iron turnings, and charcoal, is covered by a patent. But the use of iron ore, or of the oxide of iron, is not covered by a patent in this country to the best of my knowledge. I would not say decidedly, for I have not consulted the patent records to ascertain, but I think not.

* The first hearing on this date was that of S. P. Parham, Esq., one of the Engineers of the company. We are under the imperative necessity, however, of confining our reports to the testimony of the chemical experts; especially as the substance-matter of Mr. Parham's testimony is reiterated by them.—EDS. GAS-LIGHT JOURNAL.

Q. State generally, from your information, what processes are in use in Europe? A. I have learned from numerous authorities that the iron process, either as Lamings process, or as iron ore, is used in most of the large cities of Europe.

Q. To your knowledge have any of the commissioners sent to the Paris exposition reported? A. Professor J. Lawrence Smith, Professor of Chemistry in the Medical College at Louisville, and President of the Louisville Gas Company, made a report which I am informed was printed in the *American Gas Light Journal*, though I have not seen it. I have in my possession a letter from him.

Q. As a matter of information state what he says. A. He states that the oxide of iron process is generally used in all the cities of Europe. I do not like to say whether he says Europe or continent, without glancing at it.

Q. Does this process of purifying gas by iron ore require any complicated apparatus? A. The usual dry lime apparatus. Of course some minor change, but no expensive change in the apparatus is necessary.

Q. Is there any essential difference in the coal employed in this country, and that employed in Europe, which would make a process, which is successful there, unsuccessful here? A. I think not. I have analysed numerous specimens of American coal, and do not remember that there was anything peculiar in their composition. That is, the coal used for gas making. We have a great deal of anthracite, but that is not involved in the question of gas making.

Q. Generally, is it possible to obviate the present nuisance from gas works? A. I think it is.

Q. How? A. By introducing the iron process of purifying.

Q. How long would it take, in any particular gas works, to make the changes necessary—take the Metropolitan Gas works, for instance—how long would it take these to make the necessary changes? A. It is difficult to say how long. Would have to procure their oxides of iron. I should think two or three weeks.

Q. Would it interfere meantime with their manufacture? A. Not at all. Particularly as they have four idle purifiers. They could experiment on those without interfering at all with the four purifiers now employed for the dry lime process.

Q. Are sulphuretted hydrogen gas and the sulphide of ammonium injurious to health? A. They are both poisonous gases.

Q. The question was are they injurious to health? A. They are.

Q. Did you ever know any one to be injured by them? A. One of my assistants was rendered insensible by breathing sulphuretted hydrogen in the larboratory at Union College.

Q. Are all persons equally susceptible to them? A. No; they are not. My instructor in Berlin could not breathe sulphuretted hydrogen without getting the head ache at once, while I have never suffered from it. Numerous instances have occurred in which persons have been killed by sulphuretted hydrogen.

Q. Why is sulphur removed from the gas at all? A. Because it produces *sulphurous acid*, the burning of which vitiates the atmosphere; and it also acts upon metal, brass and copper, and would injure the brass fixtures.

Q. Why is the ammonia removed? A. If it is left in the gas it produces *nitrous acid*, which would vitiate the atmosphere.

Q. Why is the carbonic acid removed? A. Because it diminishes the illuminating power of the gas.

Q. Is there any sanitary objection to the carbonic acid gas being allowed to go through the main? A. I should say not; for the reason that the combustion of the perfectly purified gas would produce many times as much carbonic acid as would commonly be contained in it. Consequently the quantity in the gas is a very trifling matter.

Hearing adjourned to Thursday, August 13, 1868, at 11 o'clock A. M.

NEW YORK, FEBRUARY 6, 1869—1 P. M.

CONTINUATION OF THE HEARING BEFORE J. C. HAWLEY, REFEREE

Professor Chas. F. CHANDLER recalled and cross examined by Ex Judge H. C. VAN VORST, testified as follows:

Q. Have you given much attention to the chemistry of illuminating gas? A. I have been interested in the chemistry of gas to a greater or less extent for the last fourteen years.

Q. Have you had occasion to visit many gas works? A. Quite a number.

Q. In Europe? A. Some in Europe.

Q. In this country? A. In this country.

Q. Have you visited the Philadelphia gas works? A. I think I did visit them, but I have not a very definite recollection. I saw all the sights in Philadelphia that interest chemists. I think I have visited the gas works there.

Q. Can you state what process is in use in the United States for the purification of gas? A. The dry lime, or the wet lime process.

Q. Which generally? A. The dry lime, I think.

Q. How extensively does that prevail? A. Almost entirely.

Q. Are you acquainted with any exceptions to it? A. The New York Gas Company of this city, and two or three companies in New England.

Q. Can you say where those gas companies in New England are located, that use any other process except the dry lime process? A. I should not like to say definitely.

Q. You don't know? A. I have seen statements and letters from parties using the other process; but I have not interested myself sufficiently on that point to ascertain.

Q. Can you say then that any process for purification, except the dry lime process, is used of your own knowledge, by any other company except the New York company, to which you have alluded? A. I have not seen it—no.

Q. Nor can you mention by name any other company in any place that uses any other process, except the lime process? A. Well, I think the Worcester and the Malden, are using the iron process.

Q. Do you know that they do? A. I have been so informed. I think those companies were the ones.

Q. You think you have been informed! A. I have been informed that companies were using it, but my memory is a little uncertain as to which companies they were.

Q. In the United States? A. Yes, sir, but I am a little uncertain as to which.

Q. Except the New York Company? A. Yes, sir.

Q. Do you know Professor J. LAWRENCE SMITH of Louisville? A. I do—yes, sir.

Q. You have spoken about him on your direct examination? A. I have.

Q. Have you received some communication from him? A. Yes, sir.

Q. He is the President of the gas company at Louisville? A. Yes, sir.

Q. Do you know what process of purification is adopted in his company? A. I suppose the dry lime process.

Q. You suppose that this is in use in his company? A. Yes, sir.

Q. Did you then mention all the elements of crude gas?* A. I think not. It was not my intention to mention them all.

Q. What elements do you now state to be in the crude gas which you did not then state? A. There is such an indefinite number found in the gas, and I have mentioned only those most important, that I should have to refer to my evidence to say which I did mention. I do not recall any important constituent that I should like to add to this list.

Q. There are none that you desire to add to it? A. No.

Q. Did you regard carbolic acid, or phenol, as important? A. I did not.

Q. Is it a constituent of crude gas? A. There are minute traces of it in the crude gas.

Q. Have you visited the Manhattan works? A. I have.

Q. Did you not then discover the presence of phenol—indications of it? A. There was a slight odor which might be called that, and there might be a dozen other things—not with certainty.

Q. Where did you discover that? A. I may say that there was a substance there that one of my companions† pronounced to be phenol, though I did not feel certain about it. It was discovered about the spent lime which had been used to purify the air drawn from the main purifiers; also in the air which the Manhattan Company was allowing to pass into the atmosphere, in which we also discovered sulphuretted hydrogen.

Q. When you say in your testimony that the waste lime contains but small quantitities of ammonia do you include that contained in sulphide of ammonium or only free ammonia? A. I include ammonia in all forms.

Q. Is there not such an excess of ammonia in all cases that all the ammonia must be in the form of sulphide of ammonium?

Witness.—Do you mean in the gas or refuse lime?

Counsel.—Refuse lime.

A. No; I think not.

Q. Why not? A. Because there is an excess of lime there.

* Referring to Prof. Chandler's former testimony.

† Prof. Wurtz.

Q. Is there much naphthaline in the waste lime? A. There is some naphthaline.

Q. Not much? A. No, I should say not much.

Q. Have you visited the Manhattan works since your direct examination? Yes, sir.

Q. Have or have not your views of the constitution of waste lime been modified by your observations during your visit to the Manhattan works—waste lime as spoken of in your testimony? Your testimony was given with regard to the character of waste lime after it had acted as an agent in the purification of gas. A. Then my views have not changed with regard to the character of waste lime in general.

Q. Has it in any regard changed? A. It has changed somewhat in regard to the waste lime of the Manhattan Gas Company.

How so? In what regard has it changed? A. I don't consider the waste lime of the Manhattan Gas Company nearly as offensive or as liable to produce a nuisance as that of companies not employing the process used there.

Q. What do you understand by the term nuisance?—you use the word. A. Something so disagreeable to the senses or the sense of smell, in this case, as to cause complaint.

Q. Can you move in any direction in the city without incurring something which is disagreeable to the sense of smell? A. Yes, sir, I walk up Fifth Avenue frequently without smelling any disagreeable smell.

Q. Is that the only exception you make? A. No.

Q. Generally? A. Nuisances are by no means rare, and they differ in degree.

Q. Generally speaking, now, with regard to moving in any direction, persons that have delicate olfactory nerves—can they go anywhere in the city without meeting something which is disagreeable to the sense of smell? A. No, I should think not.

Q. In the order of nature and the economy of the management of cities those odors are constantly being evolved? A. Yes, sir, to a greater or less extent.

Q. From a variety of causes? A. Yes, sir.

Q. Is there not, as yet, much obscurity in the minds of the chemists generally about the complete nature of the action of the lime—the complete composition of the waste and the effluvia therefrom? A. I think the main principles are pretty well settled. There is a difference of opinion about the detail and the minor reactions that take place.

Q. Is there not much obscurity still? A. There is, about the minor changes that take place.

Q. Do not these require yet considerable analysis and investigation to reduce our knowledge to precision for scientific purposes? A. They do. For sanitary purposes they do not.

Q. Is it not reasonable, Doctor, even for sanitary purposes, to expect such investigation would develop important improvements in the use of the dry lime process by which its offensive features, of which you have spoken, may be removed? A. I have no wish to predict the success of the future investigations in that direction.

Q. Don't you think that there is anything about it that would warrant any such conclusion as that? A. Only as far as the investigations are liable to result in improvement.

Q. Is there anything in the subject matter itself which would warrant such a conclusion as that? A. Conclusion to what effect?

Q. By which the offensive features of the dry lime procdss may be removed. A. I have already alluded to the fact that a process is in use in New York, in which the offensiveness is to a great extent removed.

Q. That is the Manhattan Gas Company? A. Yes, sir.

Q. Aside from that? A. Aside from that I have no reason to have an opinion one way or another.

Q. In reply to the question as to what occurs when the spent lime is exposed—the lime that has performed the office of purifying the gas—you described three or four actions, which of these predominates? A. These reactions succeed each other so that it is difficult to answer that question directly.

Q. Which predominates? A. Ultimately the oxidation of the sulphide of calcium predominates.

Q. Does not the oxydizing action predominate, as shown by the heat evolved? A. The heat evolved would not prove anything with regard to the comparative reactions which take place.

Q. Then you infer that the oxidating action predominates otherwise than is exhibited by the heat? A. Yes, sir.

Q. It does predominate? A. I infer that it predominates, from the fact, that the sulphide of calcium is the predominating substance susceptible of change.

Q. Does the atmosphere contain enough carbonic acid to give prominence to the other two actions you suppose?

A. It does.

Q. Would not the oxydating action occur with the sulphide of ammonium as well as with the sulphide of calcium, converting it into hyposulphite or sulphite of ammonia? A. I would infer from my laboratory experience that sulphide of ammonium is evolved di-

rectly into the atmosphere without undergoing material change.

Q. And you speak from no other experience except that, in that connection? A. Yes, sir.

Q. Except your laboratory experience? A. Yes, sir.

Q. Is not sulphide of ammonium a very unstable, perishable and transient substance in the air? A. While I have no doubt that it ultimately undergoes decomposition in the air, I know from years of experience that it remains intact long enough, for a considerable length of time, as shown by its persistent odor.

Q. Where was that experience obtained? In the laboratory? A. In the laboratory.

Q. I am now speaking about the external air, outside of the laboratory? A. It don't make any difference on that point.

Q. Is it any more perishable in the external air than it is in the laboratory? A. No.

Q. Is it not more readily dissipated? A. Distributed, of course.

Q. You were talking about decomposition, and not distribution. It is decomposed more readily in the external air? A. It is not.

Q. But it is distributed more readily? A. Undoubtedly, if the wind is blowing, it is distributed more readily than if shut up in the room.

Q. But is not lost. A. Do you mean by decomposition?

Q. In any way? It is lost if it is carried off by the wind, of course.

Q. And that is the only way in which it can be destroyed? A. I have already stated that it may under go decomposition.

Q. How may it undergo decomposition? A. I am not prepared to give the definite decomposition that might take place.

Q. Is it likely to undergo decomposition? A. I should think it might be.

Q. How soon? A. I can't say.

Q. How soon after being evolved? A. I can't say how soon.

Q. Have you no idea? A. No definite idea.

Q. Is chemistry unable to furnish any solution of the manner in which it is decomposed, or the time in which it may be decomposed in the external air? A. Probably it is able to do so. I don't claim to carry all the facts of science in my head.

Q. I want only to know, as far as your experience goes, whether chemistry can determine that question—as far as you know? A. I can only say that I have not studied up that particular point.

Q. Is not sulphuretted hydrogen quickly destroyed by the air? A. Yes, sir, ultimately—I suppose so. Sulphuretted hydrogen would be oxidized by the air.

Q. You make substantially the same answer to that that you do to sulphide of ammonium—that it becomes decomposed after a while? A. Yes, sir, I suppose so.

Q. Within what time after its evolution? A. That I can't say.

Q. Sulphide of ammonium being volatile, would it not be necessarily decomposed by contact with the large excess of caustic-lime left in the spent lime? A. It may be partially decomposed, but I think it is not completely decomposed.

Q. To what extent? A. I have no data to say—to decide.

Q. Would not ammonia be thus set free and the sulphtie of calcium formed? A. That reaction might occur to some extent.

Q. Is it not a necessary consequence? You say it might. A. It is not a necessary consequence, because the hydrate of lime in the spent lime is so protected that it is not capable of exerting the action which it would exert under other circumstances, as shown by the fact that it is impossible to change all the hydrate of lime in the purifiers.

Q. Is pure ammonia offensive? A. Not in moderate quantities.

Q. In quantities which are given off from such spent lime would it not be? A. No.

Q. Is the ammonia from the stables offensive? A. Pure ammonia from the stables is not offensive.

Q. Nor deleterious to health? A. No.

Q. On the other hand is it not regarded for certain complaints as healthful? A. I should not care to answer the question in regard to that—hat is to say whether it is healthful or not. I should not like to say about that. I believe it is; I am not a physician.

Q. But you don't regard it as deleterious to health? A. I shouldn't consider it so.

Q. You have spoken with some degree of favor in your direct testimony, of the kinds of oxide of iron methods, and especially of the Laming process? A. Yes, sir.

Q. Do you believe that these methods are equal in purifying the gas from sulphur to the lime process? A. Not having investigated that point myself, and finding a difference of opinion among authorities, I am not in a position to answer the question definitely.

Q. I should like to have your opinion on that subject as an expert. A. It is my opinion that, while the lime process may take out a little more sulphur than the oxide of iron process, that the diffierence in the effect of the two is not sufficient to counterbalance the other advantages of the iron process. There are several iron processes.

Q. In your opinion, then—I am going back to the question because you have brought in other matters which I have no objection to, at all—I ask you then, in your opinion, whether they are equal—these two processes, the lime and the iron—equally in purifying the gas from sulphur? A. I think there is a slight advantage in favor of the lime process.

Q. Does the iron method extract the sulphur which is in the form of bisulphide of carbon? A. That question has never been determined by experiment, to my knowledge.

Q. You can't answer the question? A. No; not to my knowledge.

Q. Does it take out Phenol? A. I should make the same answer to that question that I made to the other.

Q. Does the iron process take it out? A. It does not.

Q. Do you mean that lime takes it out of the crude gas? A. Yes, sir; it probably takes out at least a portion of it.

Q. But you can't say the iron takes out any? A. Not with certainty.

Q. You did discover in the Manhattan works evidence that the phenol had been taken out—what you supposed to be phenol? A. No; I did not suppose it to be phenol? that is, there was an odor there that reminds one of phenol, but I do not consider that in sufficient quantity, to establish its identity.

Q. What could it have been if it was not phenol? A. A hundred other things. The number of substances occurring in gas is so little known that it is not safe to decide from the slight resemblance in odor.

Q. I understand you to say that the lime process would eliminate the phenol? A. I think it would probably remove some of the phenol.

Q. How can the oxide of iron method take out the ammonia from the crude gas? A. I never said it could.

Q. It can't take it out then? A The ammonia is taken out before it comes to the oxide of iron.

Q. Does the oxide of iron take it out at all? A. I think it probably does hold a little ammonia. There is not much in the gas by the time it reaches the oxide of iron. The oxide of iron might withdraw a small quantity of ammonia if there was any in the gas.

Q. Before it left the purifier? A. Yes, sir, it might do it.

Q. Can't you say with certainty? A. I know there is an affinity between oxide of iron and ammonia, and judging from that I should suppose it would, and moreover, the oxide of iron smells of ammonia.

Q. I understand from your testimony that you speak doubtfully of the entire removal of carbonic acid by Laming's method? A. I don't think there is so much doubt about the removal of carbonic acid by Laming's method. He don't use the hydrate of lime because he uses hydrate of lime with the oxide of iron.

Q. Suppose it was subjected merely to the action of the oxide of iron without the hydrate of lime subsequently. What then with regard to carbonic acid? A. The removal of the carbonic acid would then depend on the possible action of the little ammonia which might be absorbed by the oxide of iron.

Q. Could the gas be subjected to the purification of hydrate of lime subsequent to the iron process, without serious detriment to the candle power of the gas? A. I think it might.

Q. It has been stated that the iron process does not remove the carbonic acid completely. Is that so? Has it never been so stated? A. One of our chemical advisers, who is one of the persons that I understand you propose to bring in, has made that statement.

Q. Who do you refer to? A. Professor WURTZ.

Q. Have you not yourself so stated? A. I believe I did.

Q. Was it true? A. I gave it as an opinion merely.

Q. Have you any reason to change your opinion from that? A. No.

Q. Have you visited the the New York Works? A. I have.

Q. Do you regard the Rev. Mr. Bowditch as good authority on the use of coal gas, and the chemistry of coal gas? A. I do, except so far as he has a process of his own for purifying gas.

Q. Is he not regarded as an authority? A. With that limitation, yes, sir.

Q. Do you say that there is no disagreeable odor or smell proceeding from the oxide of iron, after it has been used to purify the gas? A. There is not a sufficient amount of odor to constitute a nuisance, as I judge from my own experience.

Q. How much do you think it takes to constitute a nuisance? A. Enough to be offensive; it would probably make some difference what oxide of iron process is employed, as there are several.

Q. The oxide of iron process at the New York Works? A. That is the one I speak of when I say it is not offensive.

Q. Mr. Bowditch, in his work on coal gas, states as follows on page 21, with regard to this process of purification with the oxide of iron. That "it has its drawbacks for consumers; first: Because, since it came into use, much carbonic acid is left in gas, and thus its illuminating power is reduced; and, secondly, because when tne fouled oxide is brought out to revivify, it gives off a quantity of very offensive compounds which seriously annoy those who reside in the neighborhood of a works where fouled oxide is exposed to revivify in the free air instead of covered or nearly closed vessels and chambers." Do you agree with Mr. Bowditch in that? A. I don't, nor do any of the authorities that I have consulted.

Q. To what part of it do you not agree? A. The nuisance of the revivification of the spent iron oxide.

Q. Is that the only part you don't agree with? Yes, sir.

Q. You don't disagree with him then in what he says in regard to the carbonic acid being left in the gas? A. No.

[Continued in Supplement.]

Eastern Gas Items.

—John Trundy, Esq., agent for the Portsmouth, N. H., Gas-Light Company from the beginning of operations by the corporation, has resigned on account of ill health.

—Edward Duffee, Superintendent of the Haverhill, Mass., Gas Works, has resigned, and Mr. Stevens, of the Lowell Gas Company, has been appointed his successor. Mr. Duffee, we learn, proposes to devote himself more exclusively to the manufacture and introduction of his patent gas trays, of which we hear good reports from various companies who have used them.

—We learn from the agent of the American Improved Gas-Light Company, that the Dedham Gas Company have bought the exclusive right for their town of carburetting their gas according to the process patented by the above named company.

—The following are the dividends declared on Jan. 1st by the Eastern gas companies mentioned below:

Boston Gas Company.....	2½ per cent.,	quart'ly.
Roxbury Gas Company.....	2½ "	"
Jamaica Plain Gas Co.....	4 "	semi-ann.
Newton & Watertown Co....	3	annual.

—The annual report of Fred. E. Stimson, Inspector of Gas Meters, has been presented to the Massachusetts Legislature, and was referred to a Committee on Manufactures. It was stated that during the year ending December 31, 1868, 8696 meters were inspected, of which 5740 were new, 2865 old and repaired, and 91 presented for inspection. The number rejected was 188. Of the 91 re-inspected, 40 failed to register correctly. Of the 188 rejected, 23 registered more than 5 per cent against the consumer, one showing 20 and another 22 per cent., while 21 registered over 5 per cent. against the seller, one showing 220 per cent., a second 53, and a third 35.

Chemical Action of Light.

The interesting researches of Professor Tyndall as to the action of light on vapors and liquids may have no immediate effect upon the practice of photography, but it is impossible to say at what point in his discoveries a practical application may become obvious. Let us illustrate by a speculation upon the possibilities attending his recent discoveries. In his paper before the Royal Society he states that actinic light decomposes the vapor of nitrite and nitrate of amyl. Amyl is a radical analogous to ethyl and methyl, the hydrated oxide of amyl being known as fusel oil, as the hydrated oxide of ethyl is known as ethylic, or common alcohol, and the hydrated oxide of methyl is known as methylic alcohol. Fusel oil is known to be a common impurity in ordinary alcohol, and its presence in collodion has long been regarded as injurious, and conducive to fog, without any knowledge of the reason why it should produce mischief. Professor Tyndall's experiments suggest a series of possibilities. When fusel oil is in collodion, and comes in contact with nitric acid, either free in the bath or liberated by action of free iodine in the collodion, a trace of nitrate of amyl may be formed, and this body, being present in the film when exposed to the action of light, and possibly decomposed, would, under some circumstances, yield as a product valerianic acid, a substance answering to acetic acid, as the product of the oxidation of common alcohol, or formic acid in methylic alcohol. Or, possibly, in the decomposition, intermediate bodies, analogous to acetone or aldehyde, might be formed, with a well-known tendency to produce fog when present in a collodion film. Such a series of possibilities exist, and might furnish a clue to the fogging action of fusel oil when present in collodion, which, arguing from ordinary analogies ought not to be more inimical to success than the ordinary alcohol employed in the manufacture of collodion.—*Photographic News,*

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—EDS.]

Answer to "Enquirer."

THE FLOW OF GAS THROUGH MAINS.

TERRE HAUTE, IND., January 20th, 1869.

MESSRS. EDITORS: I must confess I looked with some curiosity for your issue of Jan'y 2d, to ascertain what would be the answer to "Enquirer" in your previous paper. Messrs. Somerville and H. H. E. did not answer the question in a manner satisfactory to my mind, as they gave no data "for the faith that was in them." We hoped that the answers would state the process on which their conclusion were formed—not clouded by algebraical formula, or, if used, made so plain that any man of average intellect could comprehend them.

Being but "a wee rush-light" in the gas world, we wished to learn; but, as no one has solved the query in the manner we would have liked to have seen it answered, we determined to do it ourselves—even if in error—as we doubted not that those having the requisite knowledge would set us right.

This matter of the calculation of the flow of gas through pipes is very little understood by the majority of the superintendents of the smaller gas works in the United States. We were therefore in hopes that the answers would be in such shape as to enable those ignorant of the principles on which such calculations are founded to better understand them, and also to carry out the design you had in view in publishing the query viz.: to make your paper the organ of information to those who, like "Enquirer," might want "light" upon this and kinderd subjects.

The superintendents of small gas works should not be offended (for we are of you) that we should say that they *may* be ignorant on the subject of the flow of gas through mains, when we reflect that in the "Annual Report" (1866) of a gas works in one of the largest cities of the Union, the following language occurs:—"The citizens of —— had complained for a number of years of an insufficient supply of gas, and for the purpose of giving the supply required, a 6-in. main was laid from —— to ——. By this 6-in. main it was supposed (should not their engineer have *known?*) that a full supply would be obtained, but from *some cause, not yet fully explained,* the supply remained deficient, and the —— were compelled to lay a 12-in. (!) main from, etc. Since the completion of this main no complaint has been made of the want of gas." So it would appear that the calculation of the flow of gas through pipes is a matter of some mystery. Again, the doctors seem to disagree; all, however, unite in one method of determining *how* the flow of gas should be calculated, but differ as to the co-efficient employed. Hughes says (page 274): "The general formula, then, which I shall propose for calculating the quantities of gas delivered through pipes in the present state of our knowledge, (after summing up all that Clegg in his works and others said on the subject) is, 1335^2 Dia. $\sqrt{\frac{\text{H. D.}}{\text{L. G.}}}$ = quantity per hour. On page 276 he further states that Mr. Pole, in an admirable paper on the subject uses this formula: 1350 Dia. $\frac{\text{H. D.}}{\text{L. H.}} = 2$, which is the same we shall use in our calculations; while Nystrom, in his "Mechanics and Engineering" (1866) page 238, gives the co efficient 780 D. ^{2}, etc.

At first we only intended to calculate the amount passed the 2 in. main 1500 yards, as we took for granted that the amount supplied by the 6-in., 4-in and 3-in. mains the specified distance would be amply sufficient to supply the 2-in. main, and subsequently concluded to extend the calculation, to show that possibly the statement of H. H. E. was correct in saying "that he can do so through a 2-in. pipe the whole distance." We assume specific gravity at .420.

6 inch, 600 yards.
$1350 \times 6^2 = 48600$ $\sqrt{\frac{1.5 \times 6}{.42 \times 600}} = \frac{9}{252}$ $\sqrt{.03571} = .18897$.
$48600 \times .18897 = 9183.942$ in one hour,
$9183.942 \times 9 = 82655.487$ in nine hours, } Through 600 yds 6 in.

4 inch, 1000 yds.
$1350 \times 4^2 = 21600$
$\sqrt{\frac{1.5 \times 4}{.42 \times 1000}} = \frac{6}{420} = \sqrt{.0142857} = .1195 \times 21600 = 2581.2$ — in one hour,
$2581.2 \times 9 = 232308$ in nine hours through 1000 yards 4 inch.

3 inch, 1000 yds.
$135 \times 3^2 = 12150$
$\sqrt{\frac{1.5 \times 3}{.42 \times 1000}} = \sqrt{.01071428} = .1035 = 12150 = 1257.125$ in one hour,
$1257.125 \times 9 = 11314.125$ in nine hours through 1000 yards 3 inch.

2 inch, 1800 yds.
$135 \times 2^2 = 5400$
$\sqrt{\frac{1.5 \times 3}{.42 \times 1800}} = \frac{3}{756}$ $\sqrt{.003969} = .063 \times 5400 = 340.2$ in one hour,
$340.2 \times 9 = 3061.8$ in 9 hours through 1800 yards 2 inch.

2 inch, 4400 yds.
$1350 \times 2^2 = 5400$
$\sqrt{\frac{1.5 \times 2}{.42 \times 4400}} = \frac{3}{1848}$ $\sqrt{.00162337} = .04029 \times 5400 = 217.566$ in one hour,
$217.566 \times 9 = 1958.094$ in nine through 4400 yards 2 inch.

R.

Tax on Small Gas Works.

TERRE HAUTE, Jan. 28th, 1869.

Messrs. Editors: Your issue of January 16th was to us one of the most interesting numbers of your valuable Journal, as far as gas engineers and superintendents are concerned. It is very improving to read the experience of others, so that gas men may act intelligently in any emergency that may arise; and, also, to enable them to form a judgment on the subjects for consideration brought forward in the Journal. Beside the instructive answer to "Enquirer," we were interested in the artiele on "The Tax on Small Gas Works," and must confess somewhat amused at the plan proposed for removing it, which, however, you endorse as "speaking to the point," but which we plain western folk cannot and will not endorse (we speak, however, for ourself alone). It is in our opinion eminently a *New York* plan, but to us savors too much of corruption.

We do not believe in "Whiskey Rings," in "Indian Loan Rings," in Pacific and other railroad rings, or the thousand and one other rings, to improperly influence legislation; and will not contribute one dollar to such an end. We are decidedly opposed to creating a "Gas Ring" to bribe our *servants* to do their duty.

It seems to us a more legitimate plan can be adopted which will secure the end in view, and the influence will come from the right source—*the people.* We *make* OUR Congressmen, and all that is needed is to get public opinion right, and we will guarantee the representative from this and every other district will do precisely what is wanted to be done by the people. *They wont stay at home if they can help it.* Now, how can these men be affected? By causing the people to see it is clearly to their interest to take off the tax on gas.

Is gas a luxury? We think not; it is an article of prime necessity, and we think if it could be furnished at lower rates, the large majority of the people in towns would gladly consume it in preference to every other light; on account of safety, brilliancy of the light in proportion to price, freedom from dirt, etc., etc.

We think that not only small but *all* gas companies are unjustly dealt with, and cannot imagine why every other manufacturer should be exempt from taxation, while this article of prime necessity should be taxed. We say *prime necessity,* for although only the middling class and wealthy use it in their business and private houses, from the necessarily high rate at which it is obliged to be sold, yet poor and rich are alike benefitted when we look at the public consumption, in the shape of street-lamps, churches, public halls, etc. A reduction in the price, it will thus be seen, will benefit every person in the community, as all have to pay their share of the tax for public lighting, churches, etc.

In a consideration of this question, we should not forget that in all communities where gas works are erected, the stockholders, as a general thing, are the active, intelligent and wealthy business men of the neighborhood. It is well-known that such men are a power in political as well as business circles. Now, it seems to us if all the parties interested would make a determined and united effort to influence each member of Congress in the locality in which they are located, the end in view will be as well secured as by the influence of a "Gas Ring" at Washington.

Should the reduction in the tax inure to gas companies? We think that directly it should not. That is we think where a gas company charges say $4 per M. and the tax is 20c. on the 1,000 cubic feet, that company should take off 5 per cent. for prompt payment within five days from the date of presentation. This would be for the benefit of the gas companies in two ways: First, by receiving full price for all delinquent consumers, and, secondly, by the *increase* of consumers from the reduction of the price virtually to $3 80 per 1,000 feet, and will also largely induce extensions.

By what means can simultaneous action be secured? Let the much-talked-of Convention of Gas Engineers and Superintendents take place this summer, say May or June, in New York, Philadelphia or Cincinnati (we would prefer New York, as then gas engineers could see all the modern improvements practically illustrated at the Manhattan, New York and Metropolitan in New York, and Brooklyn, Citizens, etc., on Long Island), where this important matter could come up for deliberation and action in the premises; or, if deemed advisable, it could be referred to a committee, whose business it would be to prepare an address stating the facts of the case, and a copy or copies sent to each gas works, urging united action in the matter. R.

AN ACT

FOR THE INSPECTION OF GAS METERS, THE PROTECTION OF GAS CONSUMERS, AND THE PROTECTION AND REGULATION OF GAS-LIGHT COMPANIES.

SECTION 1. *Be it enacted by the General Assembly of the State of Ohio,* That the Governor shall, with the advice and consent of the Senate, appoint an Inspector of Gas Meters and illuminating gas, who has a thorough knowledge of the chemical composition of illuminating gas, and of the structure and practical operation of gas meters, whose office shall be in the City of Columbus, and whose duty it shall be, when required, as is hereinafter provided, to inspect, examine, prove, and ascertain the accuracy of any and all gas meters to be used for measuring the quantity of illuminating gas to be furnished to or for the use of any person or persons, and when found to be correct, to seal, stamp, or mark all such meters, and each of them, with some suitable device, and with his name, the date of his inspection, and the number of burners it is calculated to supply; such device shall be recorded in the office of the Secretary of the State.

SEC. 2. Said inspector shall hold his office for the term of two (2) years, and until the appointment of his successor, but may be removed by the Governor and Senate, at their pleasure; and he shall receive an annual salary of three thousand dollars, which shall include his office rent and expenses, to be paid out of the treasury on the warrant of the Auditor of State. Such inspector shall not in any way or manner, directly or indirectly, be interested pecuniarily in the manufacture or sale of illuminating gas, or gas meters, or of any article or commodity used by gas-light companies, or for any purpose connected with the consumption of gas, or with any gas company, and shall not give certificates or written opinon to any maker or vendor of any meter, or of any such article or commodity; and he shall be duly sworn to the faithful performance of his duties, and shall give bonds in the sum of five thousand dollars for the faithful discharge of the same; provided, however, that no warrant shall be drawn for the whole or any part of the salary of said commissioner for any larger amount than may have been actually paid into the treasury of the State.

SEC. 3. Said inspector shall, within three months after his appointment, furnish to the Treasurer and Auditor a list of all the gas-light companies in operation in the State, and his salary for the year then commenced, and annually thereafter, shall be assessed and paid into the treasury of the State, by the several gas-light companies in this State, in amounts proportionate to their assessed valuation, as declared in the returns required in the general statutes of this State, and in case such gas-light companies, or any or either of them, shall refuse or neglect to pay into the treasury the amount or portion of said salary, which shall be by said Treasurer required of them respectively, for the space of thirty days after written notice given by said Treasurer to them respectively, to make such payment, then the said Treasurer shall institute an action in the name of, and for the use of the State, against any such delinquent gas-light company for their said portion or amount of such salary, with interest thereon at the rate of six per centum per annum, from the time when said notice to make such payment was given, and the costs of the action.

SEC. 4. Whenever the inspector shall find himself unable to attsnd to his duties in any city or town of any county *he shall* appoint temporarily, and for such time

as he may deem expedient, one or more deputy inspectors of gas meters and gas, for such county, who shall act under his direction. They shall be duly sworn to thefaithful performance of their duties, shall be as fully qualified as the State inspector, and shall not, in any manner, be connected with or employed by any gas company, and shall be subject to the same disabilities as set forth in section second, *and shall be paid by fees* for examining, comparing, and testing gas meters with or without stamping them, which fees shall be twenty-ffve cents for each meter delivering a cubic foot of gas in four or more revolutions, vibrations, or complete repetitions of its action, and thirty cents for each meter delivering a cubic foot of gas in any less number of revolutions as heretofore described, and for each meter thus delivering more than one cubic foot of gas, as before named, the further sum of 20c. for every additional cubic foot of gas delivered; provided, however, that in all cases of inspection by the deputy inspector, the gas company or consumer may appeal to the State inspector from the deputy inspector's decision.

Sec. 5. The standard or unit of measure for the sale of illuminating gas by meter, shall be the cubic foot, containing sixty-two and three hundred twenty-one one thousandth pounds avoirdupois weight of distilled or rain-water, weighed in air, of the temperature of sixty-two degrees Fahrenheit scale, the barometer being at twenty nine and one-half inches.

Sec. 6. No meter shall be set after the first day of June, 1867, unless it be sealed and stamped in the manner required by this act, and any company authorizing the setting of any such meter, or allowing the same to be used by any consumer of gas without being sealed and stamped, shall forfeit and pay a fine in any sum not less than twenty-five dollars nor more than one hundred dollars, to be recovered upon the application of any such consumer, in the name of the State of Ohio, before any Court of competent jurisdiction.

Sec. 7. There shall be provided, at the expense of the gas companies of this State, at the office of the inspector, a standard measure of the cubic foot, and such other apparatus as, in his judgment, shall be necessary for the faithful performance of the duties of his office.

Sec. 8. Every gas-light company with a capital paid in of seventy-five thousand dollars or more, and every maker and vendor of meters, shall set up, at some convenient place *upon their premises*, a gasholder, to be tested, and if correct, stamped and sealed, containing five or more cubic feet, by means of which meters shall be tested, at the average pressure at which gas is supplied in the city or town where they are to be used, attention being paid to the temperature of the room where the trial is made, of the apparatus, and of the gas. There shall be provided by every gas-light company, a test meter, of a construction approved by the inspector and stamped by him, to be used in cities and towns where no test gasholders are provided, or whenever proving by a gasholder is impracticable or inconvenient, in the examination of a meter, the inspector shall see that it is of an approved principle and shall give his particular attention to the measure of the dial plate; he shall prove the meter when set level, and for each burner which the manufacturer has stamped it to register, it shall be capable of passing gas accurately, at the rate of six cubic feet per hour; and no dry meter shall be stamped correct which varies more than three per cent. from the standard measure of the cubic foot; and no meter shall be stamped correct which is capable of registering more than three per cent. against the consumer or the company. He shall keep at his office a correct record of all meters inspected by him, with their proof at the time of inspection, which record shall be open at all times for examination by the officers of any gas-light company in this State.

Sec. 9. Meters in use shall be tested on the request of the consumer or the gas-light company, in the presence of the consumer, if desired, with sealed apparatus, as provided for in section eight, by the inspector or deputy inspector. If the meter is found to be correct, the party requesting the inspection shall pay the fees named in section four, and the expense of removing the same for the purpose of being tested, and the reinspection shall be stamped on the meter; if proved incorrect, the gas-light company shall pay such expenses, and shall furnish a new meter, without any charge to the consumer. No gas company shall have the right to charge rent for meters when five hundred cubic feet per month have been consumed. The inspector shall have authority to disconnect from, or readjust meters to the consumer's fittings, with or without consent from the company.

Sec. 10. Illuminating gas shall not be merchantable in this State which has a minimum value of less than twelve candles; that is, a burner consuming five cubic feet per hour, shall give a light as measured by the photometric apparatus in ordinary use, of not less than twelve standard sperm candles, each consuming one hundred and twenty grains per hour; every gas meter is to be tested with the burner and under the pressure best adapted to it, and the result shall be calculated at a temperature of sixty degrees Fahr. Whenever requested by the Mayor or Council of any city or incorporated village, the inspector shall report to them whether the gas supplied in their respective city or town is of a legal standard, and, also, whether it is sufficiently well purified from sulphuretted hydrogen, ammonia, carbonic acid and sulphite of carbon. When the gas furnished by any gas-light company or individual shall be found, upon inspection by any officer authorized by this act, to be of a less monthly average value than the standard required by this act, then such gas-light company or individual shall not collect from the consumer thereof the price charged or authorized to be charged for gas of the legal value, but shall make a deduction from the bills rendered, in proportion to the inferiority of the gas as reported by the inspector.

Sec. 11. Any officer or servant of a gas-light company, duly authorized in writing by the president, treasurer, agent or secretary of said company, may, at any reasonable time, enter any premises lighted with gas supplied by such company, for the purpose of examining or removing the meters, and of ascertaining the quantity of gas consumed or supplied; and if any person shall at any time directly or indirectly prevent or hinder any such officer or servant from so entering any such premises, or from making such examination or removal. such officer or servant may make complaint under oath to any justice of the peace of the county, wherein such premises are situated, stating the facts in the case, so far as he has knowledge thereof, and the said justice may thereupon issue a warrant directed to any constable of the city or town where such company is located, commanding him to take sufficient aid and repair to said premises, accompanied by such officer or servant, who shall examine such meters and ascertain the quantity of gas consumed or supplied therein, and, if required, remove any meters belonging to said company.

Sec. 12. If any person or persons supplied with gas, neglect or refuse to pay the amount due for the same, or for the rent of the meter or other articles hired by him or them of the company, such company may stop the gas from entering the premises of such person or persons; in such cases, the officers, servants or workmen of the gas-light company may, after twenty-four hours' notice, enter the premises of such parties, between the hours of eight in the forenoon and four in the afternoon, and separate and take away such meter, or other property of the company, and may disconnect any meter from the mains or pipes of the company. No gas company shall have the right to refuse to furnish gas on account of any arrearages due the company for gas furnished to former occupants of the same premises.

Sec. 13. Every person who willfully or fraudulently injures, or suffers to be injured, any meter belonging to any such gas-light company, or prevents any meter from duly registering the quantity of gas supplied through the same, or in any way hinders or interferes with its proper actions or just registration, or fraudulently burns the gas of said company, or wastes the same, shall, for every such offence, forfeit and pay to the company not more than one hundred dollars, to be recovered in an action brought by the company against such offenders, and, in addition thereto, shall pay the company the amount of damage by them sustained by reason of such injury, prevention, waste, consumption or hindrance.

Sec. 14. Every person who attaches any pipe to any main, or pipe belonging to any such gas-light company, or otherwise burns, or uses, or causes to be used, any gas supplied by said company, without their written consent, unless the same passes through a meter set by the company, shall forfeit and pay to said company the same fine, and in the same manner, as declared in section thirteen.

This act shall take effect from and after its passage.

March 26th, 1867.

The New York Society of Practical Engineering.

[*Reported Expressly for this Journal.*]

The regular fortnightly meeting of this society took place on Tuesday evening, February 2, at Room 24, Cooper Institute. President James A. Whitney, Esq., in the chair.

The subject for the evening was "Explosives and their Uses." Dr. Dubois D. Parmelee read a paper on this subject. He first considered the history of gunpowder and other explosive compounds, and referred their origin to a very early period in the history of European nations. He then discussed the formation of large volumes of gaseous matter, their composition, and the effect of heat in expanding the gases thus produced. It was then stated that serious accidonts often occur on account of proper precautions not being taken in the manufacture of explosive materials. It has been proposed to render gunpowder less dangerous by mixing fine sand or glass with it; thus separating the grains from each other, retarding combustion, and preventing violent explosions. A great objection, however, to this process is that the sand is liable to become separated from the gunpowder in transportation; thus restoring the dangerous properties of the latter. The writer now described several other explosive compounds. The *pulvis fulminans* consists of two parts of carbonate of potassa, one of sulphur, and one of nitre. Whea heated carefully to the melting point it explodes with great noise. An invention made by Mr. Harsley and Dr. Ehrhardt is composed of a mixture of chlorate of potash with permanent organic substances, such as gallic acid or tannin. Chlorate of potash as a component of explosives has been used by a German, named M. Hochstatter. He employs a mixture composed of fine charcoal, sulphide of antimony, chlorate of potash. The mixture is reduced to a paste-like consistency, and sheets of blotting paper are steeped in or coated with the mixture, after which they are made into rolls and dried.

Gun-cotton, the next substance noticed, and which is a highly explosive compound, was discovered in 1845, and is obtained by soaking cotton in nitric and sulphuric acids. It has been ascertained to possess an explosive force of about three times that of gunpowder. Gun-cotton burns with almost inconceivable rapidity, and is therefore not available for all purposes for which gunpowder is used. Many efforts have been made to regulate its combustion, but as yet no decided success has been reached. The intermingling with it, of raw cotton, however, has been tried with better and more promising results.

Nitro-glycerine, another explosive substance, was next taken up, and its nature and uses set forth. Nitro-glycerine is made by precipitating glycerine in a mixture of nitric and sulphuric acids, and subsequent washing of the precipitate in clean water. The explosive power of this substance is estimated to be about ten times greater than gunpowder. Nitro-glycerine freezes at a very moderate temperature, and when frozen, becomes extremely dangerous to handle, as the friction produced by the contact of its particles is often sufficient to cause its explosion. It is claimed that nitro-glycerine may be rendered inexplosive by mixing with it wood naphtha, and that it may by precipitation be again restored to its original explosiveness and power. Its precipitation is effected by the simple addition of water. In blasting with nitro-glycerine, the charges are exploded by means of electricity, through the medium of a suitable fuse. The most efficient fuse now generally used in this country for the purpose is the Bishop fuse. This fuse is made of two copper wires insulated by gutta-percha, and inserted into a short wooden tube. This tube having been filled with priming powder is inserted in a copper cap containing a fulminating powder. This fuse is applied to the nitro-glycerine, and its wires are connected with other wires leading from an electric machine. By this means ignition is imparted to the charge.

After the paper had been read the audience was entertained by Col. Chester, Col. Burstenbinder, and others, who spoke at some length on the subject of explosions, and nitro-glycerine in particular.

After this, the meeting adjourned, to meet again on Tuesday, February 16th.

Impurities of Water.

Chemically speaking, pure water does not exist. Rain-water always contains ammonia or nitrous compounds. Ordinary distilled water also always contains traces of ammonia or other organic substances. We can, however, by observing certain precautions, obtain distilled water very nearly chemically pure; but then it becomes almost impossible to keep it so, for water may be said to resemble, to a certain extent, the alchemists' Universal Solvent, inasmuch as it dissolves greater or less quantities of almost all substances. The expressions *soluble* and *insoluble* in water are therefore usually only relative. We have substances of all degrees of solubility, from those dissolving in any proportion, to those requiring fifty or a thousand parts of water for solution. To this cause is due the difference in natural waters. These always hold various mineral salts in solution, derived from the soil or rocky strata through which they have passed. When these salts are present only in moderate quantity, they do not injure the water for ordinary purposes; or, in other words, they are not practically impurities. In large quantities, they make mineral or saline waters. We have also the division of well, spring, and lake waters into hard and soft, according to the amount of lime they contain. But, besides the mineral substances, that, as they are always present, may be termed essential, our waters are liable to be contaminated with various accidental impurities. These are of a more important character since they are not always easily recognizable, and are often injurious to health. From a variety of causes, these impurities have not attracted much attention, but at the present time their importance is acknowledged, and the determination of their nature and effects has become one of the most difficult of chemical problems. We propose, in the present article, to touch upon some

of the salient points of this subject, without entering into its minute details. It is a matter which especially affects the dwellers in cities. A man living under his own vine and fig-tree may also have his own spring or well; but the inhabitants of a large city depend upon a common source for their supply of water, and when this becomes impure, all must experience its evil effects. It is soluble organic impurities that are most to be dreaded, and especially the presence of some forms of d caying organic matter in drinking water. We will take up this point again farther on.

Water supply is usually obtained from lakes or rivers. Lake water of course is to be preferred, when obtainable. Especially is it the best when the lake is so situated that it is fed only by springs or brooks, and does not receive the drainage of towns or factories. In this way it is certain that, under ordinary circumstances, it will not be contaminated by organic matter. Occasionally, fungoid or other vegetable growths may be found in it; but such causes will produce only transient effects. River water always holds in solution more organic matter than lake water. Often it holds in suspension, mud, largely organi c; and, beyond all, it is likely to receive the drainage of the towns, villages, and farms along its banks. Muddy or turbid water can be easily freed from suspended matter by settling or filtration; but, of course, the soluble constituents are not affected by either operation. We have said above that it is soluble organic impurity that is most to be dreaded. This is true, with the qualification that the effect upon the water depends upon the kind of organ'c substance present. Here, we at once meet with difficulty; for we have not yet a satisfactory way of determining this point in every case. Quantity gives no certain indication; for, of two specimens of water, one may perhaps contain three times as much organic matter as the other, and the first be harmless, while the second may be positively poisonous. Neither the taste nor appearance is of much value. One English writer says that he examined some water from a well near a churchyard, that was loaded with organic matter of a most dangerous character, and yet was beautifully clear, and of a fresh, pleasant taste. We remember drinking water, ourselves, for several months, that was distinctly yellow, and yet perfectly good. Chemists have not yet been able to satisfactorily explain these differences, although one thing seems to be tolerably certain—that nitrogeneous substances are much more dangerous than non-nitrogeneous: and this brings us naturally to the most important of the questions relating to water and water supply—the contamination of water by drainage and sewage. Many cities obtain water from rivers, along whose banks towns, villages, and manufactories have been built; such water must become more and more impure and unwholesome every year. Any one who has stopped a short time in Cincinnati must be convinced of this. Buildings reach for some distance upon the banks of the river (the Ohio), directly above the pumping works; while, farther up, numerous towns and villages are found, increasing in number and size every year. The drainage of all these places must, of necessity, deteriorate the water. The inhabitants may become accustomed to its use;—but, judging from our own experience it affects strangers very unpleasantly. In London, this evil has become very great. A large part of the metropolis is supplied with water from the Thames; and as the population along its banks has increased its water has grown worse and worse. Water that may contain sewage should never be used. Nothing seems more likely to breed a pestilence or produce putrid diseases. Prof. Frankland, in a lecture before the Royal Institution, said: "This hurtful matter is believed, on very strong evidence, to consist of spores or germs of organisms, which are capable, under favorable circumstances, of producing in man such diseases as cholera, typhoid fever, and dysentery." Such spores or germs will be better able to resist decay than unorganized matter, and so can retain their powers of mischief for a longer time. In London, the matter of future water supply has become of great importance, and, in connection with it, examinations and analyses of a large number of waters have been made. The attention of chemists has been drawn to the subject, and a thorough revision of water-testing and analysis is now going on. Wanklyn, Smith, Chapman, Frankland, Armstrong, and many others are engaged upon it; and, although some of them seem to have done, so far, more quarelling than work, it is to be fervently hoped that they will place water analysis upon a surer foundation. Finally, we would say that, in testing the goodness of water, any sample containing much organic matter should be at once condemned, even though it seems to be very good; and also that, in choosing a water for household purposes, it is important to see that it comes from a source that does not receive the drainage of houses, manufactories, swamps, or graveyards.—*Boston Journal of Chemistry.*

—The *Railway Times* urges as the remedy against the building of competing roads along some of the main lines of trade, the laying of a third track to accommodate the increasing traffic.

New Method of Heating Cars.

A new method of heating passengers cars has been recently tried on the Connecticut River Railroad, and which the *New Haven Journal* describes as follows:—A bonnet is placed on the top of the car at each end, to catch the wind while the car is in motion, and the air rushes down a pipe in the corner inside, close to a stove which is made with a hot air jacket, and attached to the chamber formed by the heater and jacket surrounding it. On the floor of the car stands a closed box, partly filled with water. The air, whether filled with dust or not, which enters the bonnet, rushes directly into this water box, where it is thoroughly washed, and passing into the heater, is forced in an absolute pure state into pipes that run near the floor, the whole length of the car, on each side and under the seats. At proper intervals these pipes are perforated with small holes, through which the heated and purified air then escapes. The whole arrangement gave gseat satisfaction to all on the cars, and it is thought that a great advantage has been gained to the travelling public by this invention. The apparatus is as easily governed and regulated as the simplest stove, and not at all cumbersome, but quite light and ornamental, and does not cost half as much as some other attempts at car-heating apparatus. The warmth is distributed equally throughout the entire length of the car, and coming low down toward the floor will enable passengers to always keep their feet comfortably warm.

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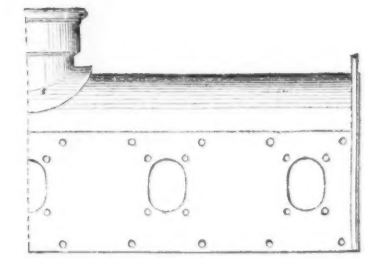

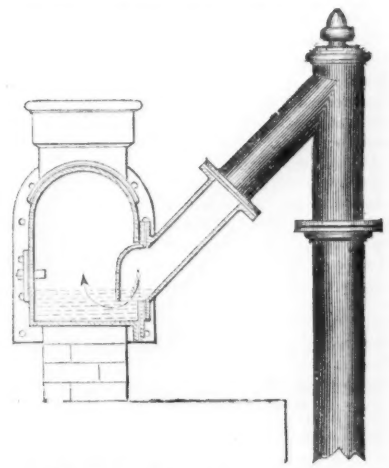

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PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

TUESDAY, FEBRUARY 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFEICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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CONTENTS

Improved Pump 247
The Gas Companies and the Board of Health 242
Chemical Action of Light 244
CORRESPONDENCE—
The Flow of Gas Through Mains 245
The Tax on Gas Works 245
An Act for the Inspection of Gas Meters, etc., in Ohio 245
The New York Society of Practical Engineering 246
Impurities in Water 246
New Method of Heating Cars, ... 247
Answers to Correspondents 248
EDITORIALS—
The War of the Purification 248
The Law for the Inspection of Gas and Gas Meters in the State of Ohio 248

NOTICE.

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TO OUR SUBSCRIBERS AND PATRONS.

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Answers to Correspondents.

J. G., of Mass.—A mixture of atmospheric air with olefiant gas is much more explosive and detonates with far greater violence than when pure hydrogen and atmospheric air are mingled together. Consequently, in analyses of gases rich in olefiant gas great care is necessary in firing the mixture, or serious consequences may ensue.

O. S., of Pa.—The illuminating power of a candle is greater as soon after the lighting of the wick as the fat begins to melt and flow freely; and previous to the crusting of the wick. As soon as the latter condition commences, the intensity of the light decreases.

E. D., of Ga.—Lime is necessary for cleansing gas as an absorbent of sulphur, ammonia, and carbonic acid, while the washers are indispensable for the initiatory treatment of the nascent gas.

A. W., of Vt.—The turbine wheel to which you refer, that was to be driven by a stream of water forced through it by a steam engine, and that had its origin in Newark, N. J., is *non est inventus*.

J. C., of Me.—So far as we know, no treatise on the manufacture of fire-brick has ever been published in this country.

THE WAR OF THE PURIFICATIONS.

Our readers will readily remember the attack made upon the Gas Companies of this city during last summer by the Metropolitan Board of Health, apparently with a view to forcing them all to the disuse of hydrate of lime for purification, and to the use of the oxide of iron therefor. Our largest company, the Manhattan, at once caused a complete chemical examination to be made into the whole subject, according to our present lights; and at the instance of their President, Gen. ROOME, a brief but comprehensive Report was prepared upon the subject by our chemical collaborator, Professor HENRY WURTZ, in which the relative merits and efficiency of these two prevailing modes of purification were discussed in aspects both scientific and practical. The general conclusions of Professor WURTZ were to the effect that oxide of iron (at least as now used) was far from being adequate to supersede or displace hydrate of lime for the uses of the gas chemist; and, with regard especially to the Manhattan Company, that the scientific skill for which their officers are so pre-eminent has enabled them to apply and perfect an improvement in the dry-lime process which does away with all the objections alleged against it. This Report was published in November last, in a pamphlet form, and, we remark, has just been copied in full in the last issue of the London *Journal of Gas Lighting*. Its effect has apparently been satisfactory, as we have heard of no further proceedings of the Board against the Manhattan Company.

With another of our large companies, however, the Metropolitan Gas-Light Company, whose works are on the North River, at the foot of 42nd street, the Board is still pursuing its point; and having refused to grant that company the full period of time asked, for investigation (till March) is at this time occupied in endeavoring to prove, by testimony ttaken under the usual legal formalities, that the purifying operations of the Metropolitan Company constitute in the eye of the law, and in *every sense*, including the worst senses, of that vague term, a *public nuisance*—and must be at once remodeled or suspended!!

The following is the "Order No. 425" of the Board of Health (omitting the usual preamble):

"*Ordered*, That the business of manufacturing gas (conducted by the Metropolitan Gas Company) at the foot of West 42nd street, New York, be discontinued, except it be conducted by a process of manufacture that will not allow any *deleterious gases or odors detrimental to health* to escape into the external air."

(The italics are ours, intended to indicate or emphasize the ground of accusation or cause of complaint; the onus of proving which, by legal evidence, would appear to rest upon the Board.)

The nature of the proceeding and its significance to the public are readily seen when we consider that this company is now working to the full extent of the capacity of its large establishment, and straining every nerve to keep up its supply (this being the season of maximum consumption) of *one million feet per day*, of good gas, to its district; and that this district comprises that belt of the city between 34th and 79th streets, extending from river to river; this company supplying light, therefore, probably to the major part of the better class of our private residences (and the streets on which they lie.) The effects of any disturbance of the machinery of supply of light to this district may be at least feebly imagined by all. We may suggest that it would certainly make a season of jubilee and carnival for a class of the population that is by no means a favorite one, we judge, with the Board of Health.

Our *present* position, as a journal, in this affair, is clearly definable. It is that of a neutral; until the testimony on both sides has been concluded. It is true, we assume, that we have earned the position of the sole organ of the Gas Interest on this continent, as affects both producers and consumers; but when a question such as this, of such vital import to both these classes, is before one of the tribunals charged with the execution of the laws of the Commonwealth, it would not be decent for us to prejudge the case.

Nevertheless, our neutrality must needs be an *armed neutrality*, and we therefore solemnly protest against and denounce an article which has appeared in the *New York Daily Times*, of February 12th, in which, to use the mildest language, a purely partisan view of the question is maintained, and which purports to emanate from the very tribunal itself that is sitting in judgment, being signed "A HEALTH OFFICER." We would fain believe that there has here been some mistake.

Our own enterprise in placing *exclusively* before the public, in other columns, the chemical testimony in this important case, will doubtless be recognized by our readers. We wish, however, more particularly to point out the remarkable excellence and accuracy of the *stenographic* work performed, which, considering the inherent difficulties of the case, and the abundance of scientific and technical terms, has certainly never been surpassed in any country.*

As for the local ephemeral press, upon which it would seem incumbent to give the public at least an inkling of the real nature of a controversy so greatly involving its comfort and its interests, they have been content with presenting a few garbled sentences, at second-hand, tending (if not intended) wholly to mislead; or with scoffs and sneers, instigated by the strange and unaccountable delusion (continually nursed by themselves) that the interests of gas manufacturers are inevitably inimical to those of their customers; whereas, in this very case, if it should be decided that the course of the Metropolitan Gas-Light Company has been a mistaken one, in wishing to delay the endangering of the economy and productiveness of their works by new experiments, until the time when the consumption of gas usually falls off, in the Spring; the worst that any just man will place to their charge will be a preference to offend a few rather than the many, to retain a bad reputation a little longer rather than risk an almost certain disaster to the community in general.

While, as aforesaid, our position is perfectly neutral, we are certainly not defending the Metropolitan Gas-Light Company, when we claim from the public a suspension of judgment on the ground that time should be permitted that compony to examine fully and by experiment into the several new plans that offer before adopting any one.

* The opportunity is taken also to state that an occasion was found to submit the proof of Professor CHANDLER'S testimony on his cross-examination by Judge VAN VORST to the Professor himself. The gentleman to whom we are indebted for the stenographic reports of this case is Mr. CHAS. P. YOUNG, of 137 Broadway.

THE LAW FOR THE INSPECTION OF GAS AND GAS METERS IN THE STATE OF OHIO.

The Legislature of the State of Ohio have enacted a law for the protection of gas consumers and gas companies, which is in reality nothing but a burden and an unjust taxation of the gas companies in that State. The law provides a salary of $3,000 a year for the State Gas Inspector; the salary to be paid by the various gas companies of the State. But as the Inspector himself is certainly not able to perform the duties required of him in all places where gas companies are in operation, he has to appoint Deputy Inspectors, whose fees have also to be paid by the gas companies.

It was provided that the law should be enforced from and after the first of June, 1867, but the gas companies of the State were informed by the Gas Inspector, T. G. Wormley, Esq., that he was not ready by that time, and another circular was issued on the 14th of August, which reads as follows:

OFFICE OF STATE GAS COMMISSIONER,
COLUMBUS, O., August 14th, 1867.

The State Gas Commissioner having received the necessary apparatus, and fully established its accuracy, is now prepared for the examination of gas provers and meters. Gas companies located in cities or towns in which a deputy inspector has been appointed, can have their meters examined by such deputy. All other companies will, for the present, send their meters to Columbus for inspection. Companies will communicate at once to the Commissioner, or to his duly appointed deputy, the number of meters they at present desire examined. They will then be informed of the earliest day at which it will be practicable to have the examinations completed. These examinations will be made in the order in which the applications are received. In ordering new meters or provers, the Commissioner would suggest to gas companies that they be ordered directly to Columbus. Consumers desiring meters examined, will, for the present, have them forwarded to the State Commissioner, unless there be a deputy inspector in the city or town in which the examination is desired, when the inspection can be made by said deputy. In case the authorities of any city or town desire complete and regular reports of the quality of the gas furnished their respective city or town, it will be necessary that they provide an approved photometer and suitable room for making the examinations. Under those circumstances, the Commissioner will instruct and appoint a deputy for such city or town, who, if desired, will make daily photometric observations, and, when deemed necessary, collect and forward samples of the gas to the Commissioner for chemical examination. If, in any case, a gas company or consumer intends to appeal from a deputy inspector's decision to the State Commissioner, it is requested that, if practicable, such intention be made known to the deputy at the time of his inspection.

THEO. G. WORMLEY,
State Gas Commissioner.

Now, as to gas companies to sending their meters to Columbus. It seems to us that there is no doubt *that every gas company has the undeniable right and privilege by the law to have their meters examined upon their premises.* In section 4 of the law it is provided that *whenever the Inspector shall find himself unable to attend to his duties in any city or town, he shall appoint one or more deputy inspectors;* and, further, section 8 reads that gas companies, also makers and vendors of meters, *shall set up at some convenient place upon their premises,* a gasholder, by means of which meters shall be tested.

We therefore deem it proper to call the attention of the gas companies in the State of Ohio to these facts, and they will at least save time and money by reading the law carefully. Another question remains to be answered. It is whether or not the Inspector has a right to charge fees for those meters sent to Columbus and examined by him.

This is a matter of general interest, and as other States will perhaps enact similar laws, the action of the gas companies of the State of Ohio will be looked at as a criterion and we hope they will show by their combined action that they appreciate the fair interpretation of said law.

We learn from the annual reports for 1867 and 1868 that there has been but one Deputy Inspector appointed for the city of Cincinnati, and all other companies are still requested to send their meters for examination to Columbus.

We publish the law referred to above in full, and which will be found on page 245.

PROFESSOR HENRY WURTZ

HAS EFFECTED ARRANGEMENTS WHICH give him especial advantages in Analyses of Gas and Gas Coals, and in the practical determination of the value of Coal for Gas-Making purposes. Analyses of Ores, Minerals, Mineral Waters, etc. No. 26 Pine street, N. Y.; or this office.

☞ Owing to the voluminous examinations now being taken before the Board of Health relative to the so-called gas nuisance, we have published a supplement to the present issue, which has caused the delay of publication on the regular day. We trust our patrons will appreciate our efforts to lay before them a subject of such vast importance.

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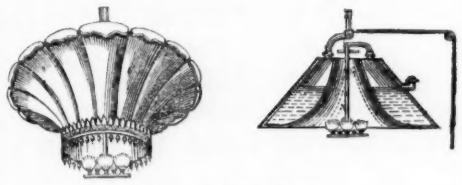
WE, THE UNDERSIGNED, PROPRIETORS OF the Gas Works of this place, on account of being desirous of engaging in business at some other place, offer the works for sale on liberal terms. The Works are in good running order. Tamaqua, Pa., is a thriving business place in the coal region. There is in construction a new railroad to pass through this place, intersecting with the Lehigh Valley Railroad. For further information relating to the same, apply to German, Zehuer & Co. 4t

A MIDDLE-AGED MAN OF BUSINESS HABITS for many years engaged in Machinery, particularly that connected with Gas and Water Works, Plumbing and Gas-Fitting, about starting on a Tour through the Western States, will act as Agent for anything in the above line. Undoubted reference given. Address Box 1,513, P. O., New York. 219-2

The New Light.



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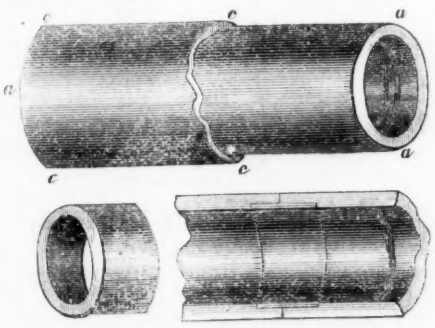
Will be paid to any one who can produce from OXYGEN GAS or any other source, a light as cheap as that supplied by the Hydrocarbon Light Company, or that can prove that one foot of New York gas cannot be made by their process to give a light equal to three feet. Suitable for all purposes of illumination. May be seen in practical operation at the Company's store, 74 Maiden-lane, or at 839 Broadway, New York, and Messrs. Oppenheim & Co.'s, 251 Fulton street, Brooklyn. 219



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A SYSTEM FOR KEEPING THE

Books and Accounts of Gas Companies.

BY W. P. FODELL.

This work is gotten up by W. P. FODELL, Secretary and Treasurer of the NORTHERN LIBERTIES GAS COMPANY, Philadelphia, and is a compilation of forms for books and directions for their use, and is intended to present a system that shall be at once plain, orderly and full, from which reports and statements of the conduct of the works of any required nature can be made at any time.

The work will be divided into four parts, each connected with the other, viz:

PART I.—Relating to the Manufacture of Gas—Superintendent's Department.

PART II.—Relating to Registration of Consumers—Registrar's Department.

PART III.—Relating to Collection of Bills—Receiver's Department.

PART IV.—Relating to Stockholders—Treasurer's and Secretary's Departments.

Any one or more of the books of each department might be used in the infancy of a work, without adopting the whole; or incorporated into a work already in operation.

Builders of gas works could put this book in the hands of a person of ordinary intelligence, enabling him to keep the history properly.

The work will also contain forms for Constitution and By-Laws, rules for transfer of stock and paying of dividends, terms, etc.

The Author has had very considerable experience in, and given much time and attention to the subject.

The subscriptions will be received at the office of the American Gas-Light Journal. The price will be $3.00. When a sufficient number is received the work will be published.

Any Gas Company desiring any or all of the books comprised in this set, can be supplied by application to this office. The books will be furnished ready for use with directions.

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THE ADVERTISER IS THE INVENTOR AND Patentee of a new System to Utilize Waste Steam for Heating Factories, Mills and all buildings where steam power is used. Also, for Dyers, Soap Makers, Etc. The saving in Fuel is from 25 to 40 per cent! which can be proved by numerous testimonials of those who are employing this system. Orders to have the system applied may be directed to Joseph Shackelton, 22 Pine-st., Room 10, or at 45 Courtlandt-street, New York.

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Mr. Joseph Shackelton has just completed an arrangement by which we are enabled to apply the exhaust steam from our engine for the purpose of heating water used for dyeing, felting, scouring and other purposes. We have made a careful test of the amount of fuel saved by the use of this arrangement, and find it to be from forty to fifty per centum. MOORE & SEELY BROS.

Newark, N. J., December 18, 1868.

Mr. Joseph Shackelton—Sir: This is to certify that I am using your system of using the exhaust steam from my engine. It has been in operation for three months, and works satisfactory in all respects. I find a saving of coal of about 50 per cent.

JOS. GUILAM.

We have used Mr. Shackelton's patent system of heating our kettles and factory by exhaust steam for seven months We find that there is a saving of coal of about 50 per cent.

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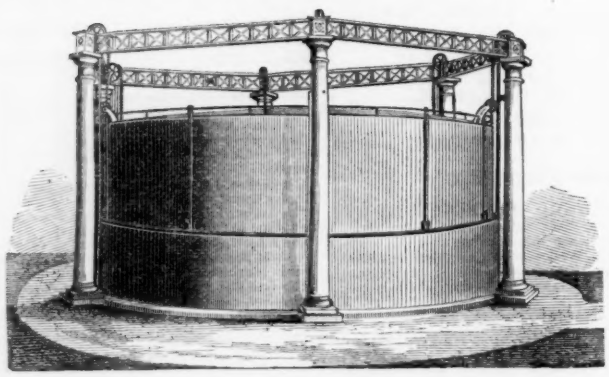

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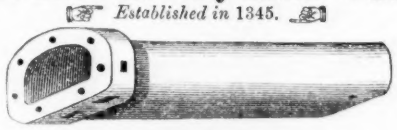

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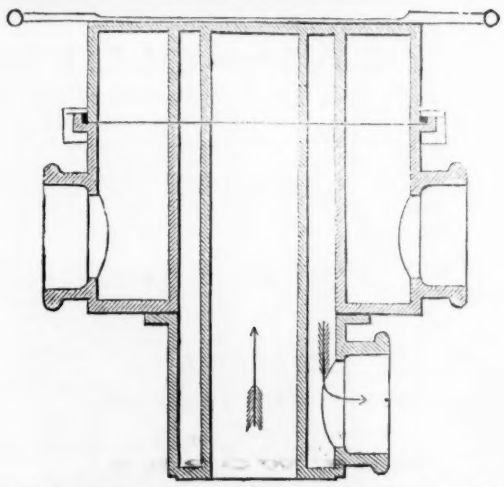

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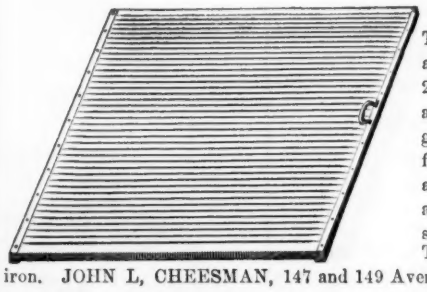

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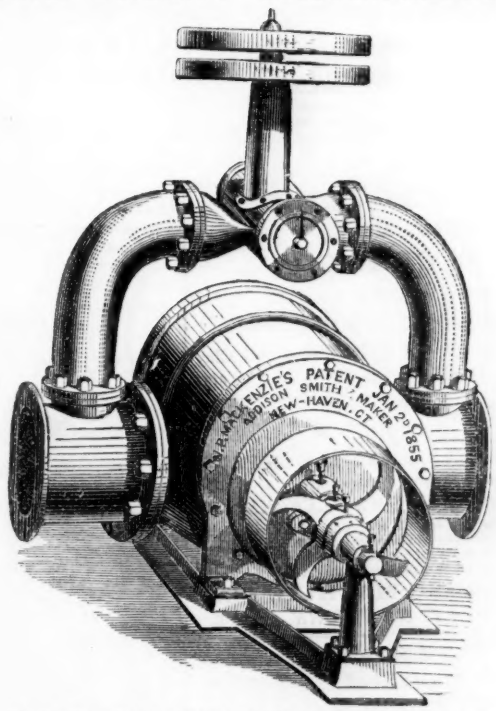

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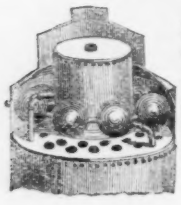

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Being upright, occupy little space, and are easily cleaned.

Without additional fuel, the Superheater increases the working capacity of the steam 25 per cent., which has been fully demonstrated by the many now in use. (See illustrated circulars).

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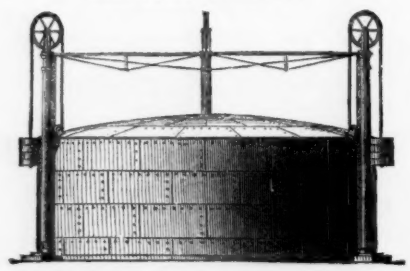

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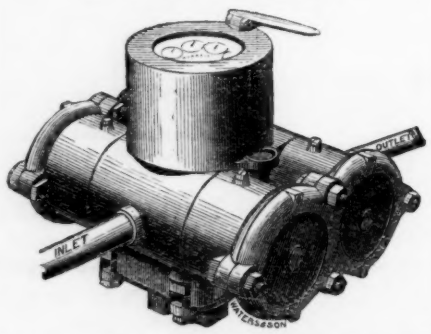

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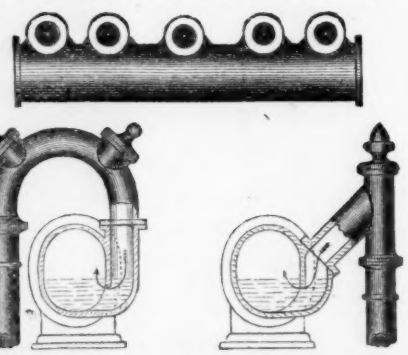

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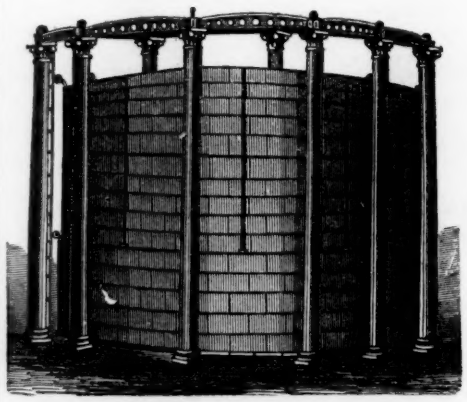

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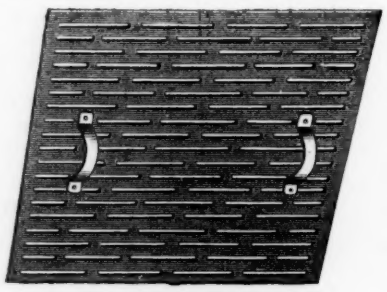

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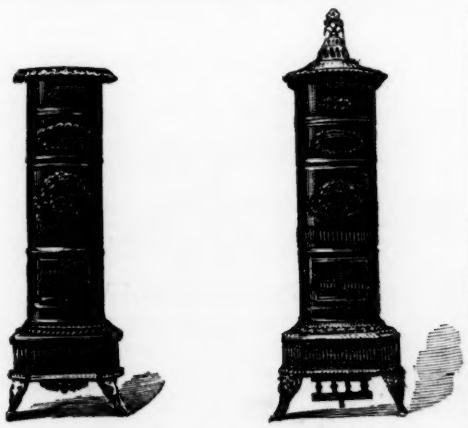

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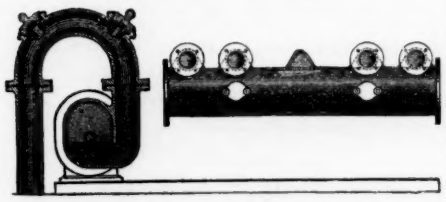

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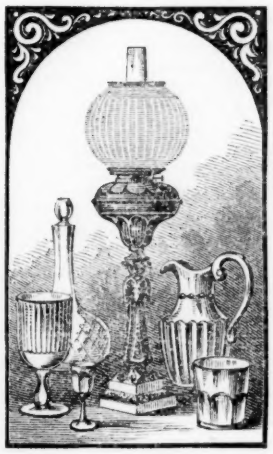

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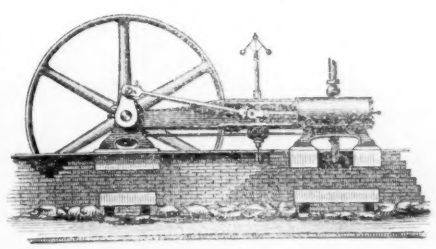

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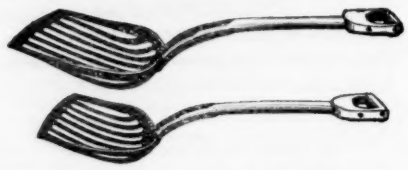

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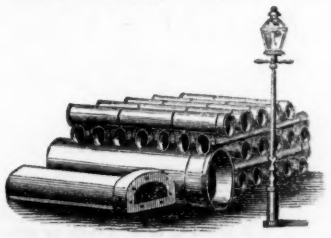

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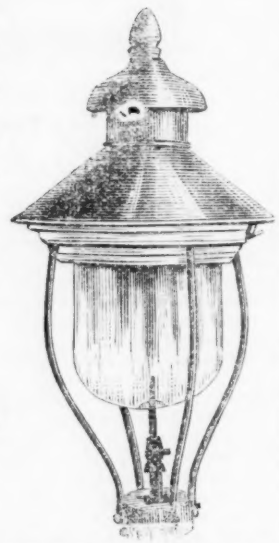

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GAS-BURNERS, APPARATUS ETC.

Arnold's Metallic Gas Trays—T. G. Arnold, 334 and 336 West 21st street, N. Y. 6
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Cambridge Gas Stoves, Ranges, &c.—Gas Light Journal Offices, 6
Contractors for Gas-Works, Etc.—Murray, Baker & Walker, Fort Wayne, Ind. 8
Gas Retorts, Etc.—George C. Hicks & Co., Baltimore, Md. 2
Gas Fixtures, Etc.—Archer & Pancoast Manufacturing Co., 9, 11 and 13 Mercer street, New York 3
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Gas Meter Manufacturers—Harris & Bro., 1117 Cherry street, Philadelphia, Pa 8
Gas Superintendent—C. M. Cresson, 417 Walnut st., Phil., Pa. 9
Gas Apparatus, &c.—Geo. H. Kitchen & Co., 561 Broadway 9
Gas Burners—Wightman Bros., 25 Kilby st., Boston, Mass. 9
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Gas Burners—W. Anderson, cor Franklin & Elm sts., N. Y. 8
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Gas Stoves—A. L. Bogart, 792 Broadway 7
Gas Fixtures, Meters, Etc., Etc.,—McHenry & Carson, Cincinnati, Ohio 4
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Jersey City Gas Meter Works. 14 Morris st., Jersey, N. J 8
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Columbian Iron Works—Wm. Taylor & Sons, 11, 13 and 15 Adams street, Brooklyn, N. Y. 7
Cast Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md. 1
Continental Works—T. F. Rowland, Greenpoint 6
Erie Basin Iron Works—Elizabeth, Dwight and Van Dyke sts., South Brooklyn, N. Y. 6, 7
Keystone Iron Works 3
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Aubin Water Meter—H. Q. Hawley, Albany, N. Y. 7, 9
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Davis' Steam Superheating Boiler—Duplex Steam Boiler Mf'g Company, Long Island City, N. Y. 9
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MISCELLANEOUS.

A Rare Opportunity for Investment—Offices of this Journal 8
Apparatus For Sale—Washington (D. C.) Gas Company 6
Bird Cages—Osborn Manufacturing Company, 109 Bleecker st. 8
Cameron Coal Company—42 Broadway 1
Despard Coal 1
Empire S. S. Line for Savannah, Garrison & Allen, 5 Bowling Green 9
Empire Sewing Machine Company, 294 Bowery 6
Finkle & Lyon Sewing Machine Company, 581 Broadway 9
Fodell's "Book-keeping for Gas Companies" 2
Gas-Light Journal American and Foreign Patent Agency 8
Opposition S. S. Line to California—177 West st., cor. Warren 9
Professor Henry Wurtz—Office Gas-Light Journal 3
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APR 8, 1859.

SUPPLEMENT
TO THE AMERICAN
GAS-LIGHT JOURNAL

NEW YORK, TUESDAY, FEBRUARY 16, 1869.

Continued from page 244.

Q. The Rev. Mr. Bowditch says in his work, as follows: "The aqueous vapors and the vapors of hydro carbons, are much heavier than the atmosphere, and when evolved from the foul oxide by the heat of chemical action, they float in the lower stratum of the atmosphere near the surface of the earth and produce extensive annoyance." What do you think about that? A. The Rev. Mr. Bowditch makes a mistake. One portion of the statement is directly at variance with the facts of the case, for aqueous vapor is only two-thirds as heavy as atmospheric air.

Q. Would not the fog arising from these purifiers of oxide of iron be heavier than the air? A. If it was heavier than the air it would not rise. So there is an inconsistency in your question which makes it difficult for me to answer it.

Q. The theory is that it remains floating in the lower stratum of the atmosphere near the surface of the earth, would not that fog arising from these purifiers float in the lower stratum of the atmosphere near the surface of the earth? A. That would depend on the condition of the atmosphere at the time as to the movement of the currents.

Q. Well, generally—the general condition of the atmosphere. We don't want exceptional cases? A. I can only answer from experience that there is not any marked accumulation of gases about the neighborhood of works using this process.

Q. Are not hydro carbon vapors heavier than the atmosphere. A. Some are and some are not.

Q. Those which are evolved from these purifiers (because I am only speaking about those, it is not in a general broad field)? A. I think they are, probably.

Q. How do you reconcile the assertion that has been made by the promoters of the iron process of the entire suppression of the disagreeable smell, with the wholly opposite statements made by other authorities. A. The only opposite assertions made by any other authority that I know of are made by the Rev. Dr. Bowditch, who has a process of purification of his own to recommend, and as my own experience agrees with the statements of all the other authorities I have consulted I am at a loss to account for the Rev. Mr. Bowditch's opinion.

Q. Then you know of no other authority than Mr. Bowditch who speaks of the disagreeable odors proceeding from the fouled oxide of iron. A. I recollect of no authority who speaks of them as at all a nuisance.

Q. Does not Clegg say the same thing sir, with regard to the oxide of iron—of the disagreeable odors arising from it? A. I don't recollect that he does.

Q. He is a good authority, is he not? A. Certainly.

Q. You don't recollect that he speaks of such odors proceeding from the fouled oxide of iron? A. I have not consulted Clegg since last summer.

Q. Since your evidence was rendered have you heard any complaint respecting the quality of gas delivered by the N. Y. Gas Light Company throughout their district? A. I saw a complaint in the newspaper which emanated from the laboratory of the chemist of the Manhattan Gas Company. It mentioned tests made in his laboratory.

Q. Is that the only complaint you have heard of the quality of the Gas? A. I have on one other occasion seen a statement in the newspaper to the effect that something had gone wrong at the gas works, by which the consumers were deprived of their supply of light.

Q. Have'nt you heard it stated with regard to the gas, that it was not very pure gas, that it had sulphur? A. Only in this instance, which came from the agents of another Gas Company.

Q. Have you tested the gas delivered by that company* for the purpose of discovering whether there was any, and if so, what amount of sulphur in the gas as delivered by it? A. I have.

Q. What was the result of your investigations on that subject, did you discover sulphur? A. I discovered sulphur every time.

Q. How often did you make those experiments? A. I have tested the gas on four or five different occasions.

Q. What method did you adopt to discover the presence of sulphur? A. The combustion method usually employed. I have also used test paper repeatedly without discovering sulphuretted hydrogen.

Q. What quality or proportion of sulphur did you discover on that occasion? A. The quantity varied.

Q. The sulphur was there I suppose. The occasion of the sulphur being there was on account of the imperfect method of the purification of the gas, was it not? A. All gas contains sulphur; gas is never perfectly purified.

Q. That is not the question. If it was perfectly purified it would be taken out. The method of purification was imperfect, was it not? A. Yes, sir. It makes me tell something which does not represent the truth when you make me answer that with a single word.

Q. How much sulphur did you discover? A. I find I have more tests here. I said four or five times but I had forgotten how many. The quantities of sulphur found in the gas varied from 21 to 45 grains per 100 cubic feet.

Q. That is more than is allowed by the English Parliamentary standard, is it not?

A. Yes.

Q. The English Parliament allows what percentage in the gas?

A. 20 grains.

Q. And, therefore, you found more there than is allowed by the English standard?

A. Yes, sir.

Q. Now, I am going to ask you this question. You use the gas delivered by the Metropolitan Gas Light Company, do you not?

A. Yes, sir.

Q. Have you tested it to see whether there is any sulphur in it?

A. I have not.

Q. But you have used it in your house?

A. Yes, sir.

Q. Have you discovered any sulphur in it?

A. I know there is sulphur in it. I should state so that I may not appear to misrepresent the facts of the case. I have made some experiments on the Manhattan and Metropolitan gas but the results determined have not been weighed, so that I cannot tell the figures. The examinations have not been completed.

Q. You say that you discovered sulphur? Yes, sir, there is sulphur in both.

Q. As they deliver it now? A. Yes, sir.

Q. The gas delivered in your house you have not specifically tested to discover whether it contained sulphur or not? A. It was tested in my Laboratory but not in my house, but the quantity I have not determined in either case.

Q. It is appreciable, is it? A. Yes, sir.

Q. I am going to ask you as an expert from what you have known of these various systems of purification and what you know of the subject matter, as an expert would you advise the Metropolitan Gas Light Company to adopt the iron process without very mature and deliberate inquiry and examination and experiments? A. I not only would advise them to do it but I did advise them to fill their four purifiers with the iron mixture and give the thing a fair trial at once.

Q. You do advise them to do so? A. I do, and I suggested that they should do it.

Q. The question as I propounded it to you is whether you would advise them to adopt the iron process without mature and deliberate examination, inquiry and experiment? A. I should. There are reasons why I should

Q. I will allow you to give your reasons. A. These reasons are so trifling that it is scarcely worth while to put them on record.

Q. I should like to have them down? A. In the first place, I consider the iron process more economical. In the second place, it would do away with the cause of this hearing.

Q. That would be entirely satisfactory to the Board of Health? A. I am not at liberty to speak for the Board of Health, and I am not the prosecuting attorney.

Q. You think it would do away with the hearing? A. I think it would do away with the nuisance, and if it did away with the nuisance there would not be a cause of complaint. That is my opinion as an expert.

Q. Do you know whether the officers of the New York Company are not dissatisfied with this method of the purification of gas, and that it does not come up to their expectations in that regard? A. On the contrary, I know that they are pleased with the process.

Q. Did you ever know or hear of an employee or visitor in any of the gas-works being killed by the effluvia from the fouled purifiers? A. I think I have heard of such cases, but I could not say with absolute certainty that the sulphuretted hydrogen which killed them was from fouled purifiers, or some other chemical source. I have heard of persons being killed by escaped sulphuretted hydrogen, but I am a little uncertain whether it occurred in gas-houses or elsewhere.

Q. I did not ask you that. A. I am a little uncertain whether it occurred in the gas-house or where.

Q. Did you ever know or hear of an employee or visitor in any gas-works being killed by the effluvia from the fouled purifiers? A. I have heard of persons being killed by such foul gases, but I am a little tle uncertain whether it occurred in gas houses or not.

Q. Or on gas premises? A. Or on gas premises.

Q. Or that the vapor escaped from the manufacture of gas? A. Yes, sir.

Q. You can't say that it was. It may have been sulphuretted hydrogen formed under other circumstances? A. Yes, sir.

Q. Do not mineral poisons, where frequently administered, generally produce some specific disease—salivation, ulceration, &c., &c.? A. Some do, and some do not.

Q. Which mineral poisons do not? A. Salt—common salt.

Q. Otherwise, do you make any other exception? A. Yes, an indefinite number of exceptions.

Q. Mercury? A. Mercury, in a sufficient quantity, will salivate, certainly.

Q. Phosphorus? A. If you breathe enough of it, it will produce caries of the jaw.

Q. Lead produces diseases, does it not? A. Yes, sir.

Q. Palsy and colic? A. Yes, sir; and paralysis.

Q. Does not the bisulphide of carbon produce a similar disease? A. I can only speak from my own experience in that case: that I have been in the habit of breathing bisulphide of carbon frequently, and never suffered any injury from it.

Q. State aside from your own individual experience as a chemist, how is it? A. Bisulphide of carbon is used so much for filling prisms, and employed by experimenters, and the fact that I have not known it to produce any ill effects, leaves me in doubt of its producing any. I have had it about my own house months together, so that you could perceive it in coming in the neighborhood of it, and never knew of any evil effects from it.

Q. In factories, haven't you heard of operatives getting disease from it? A. Never. I never read of it. Some of my old pupils are manufacturers of it too, and I know they do not suffer any injury from it.

Q. According to your own experience, are the employees in purifying-houses of gas-works subject to any special disease or diseases? A. They are not.

Q. Now, in the cases on record of the poisonous effect from sulphuretted hydrogen, was not the proportion in the air breathed very far greater than any ever occurring in a purifying house, much less in its neighborhood merely? A. It was.

Q. Which do you suppose to be the worse—free sulphuretted hydrogen or sulphide of ammonium free? A. I don't see much choice between them.

Q. You can't say which is the worst? A. No

Q. Is there any? A. I can't say.

Q. Have you ever heard of any person being injured by sulphide of ammonium? A. I have not.

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* The New York Gas-Light Company is the one here referred to, as plain from the context below.—H. W.

is a much rarer substance than sulphuretted hydrogen.

Q. Can there be really any sulphuretted hydrogen at all given off by the waste lime, considering that the predominent odor is that of ammonia? A. I could not answer that question.

Q. This is a bottle of spent lime taken from the purifier of the Metropolitan Works. Now the question is, if you will tell us what is the predominating odor? A. Ammonia. The odor of the second one is that peculiar persistent odor of gas-lime, which has not been investigated to such an extent as to make it possible to state exactly what it is.

[The counsel produces two bottles of spent lime taken, one from the top and the other from the bottom of a fouled purifier of the Metropolitan Gas Works.]

Q. Is there ammonia there also, doctor? A. I think I perceive ammonia.

Q. Try it again? A. I think there is ammonia there.

Q. Is there not an excess of ammonia? A. I think there probably is.

Q. Try, doctor, long enough to know whether there is an excess of ammonia there? A. I think there is probably some ammonia there.

Q. An excess of it? A. I think so.

Q. Is there any doubt about it? A. I think not.

Q. You have subjected it to another test? A. Yes, sir.

Q. To what test? A. Turmeric paper.

Q. Doctor, can there really be any free sulphuretted hydrogen of the kind supposed to be thrown off by the waste lime, considering that the predominant odor is that of ammonia? A. Not until after the ammonia has escaped.

Q. Is there any evidence that there is any poisonous substance given off by that lime? A. Yes, sir, I think there is.

Q. What is it? A. I think there is sulphide of ammonium escaping from the mixture.

Q. Did you ever know of sulphide of ammonium poisoning any body? A. No, I never did.

Q. Did you ever hear of anpbody being poisoned by it? A. None.

Q. Then why did you say it is poisonous? A. Because it has such a disagreeable effect on my nose and lungs.

Q. Is not almost every human being subject every day more or less to the inhalation of sulphide of ammonium, or even at times sulphuretted hydrogen, from his own excrement? A. He probably is.

Q. Are scavengers who handle such matter subject to any special morbid condition? A. They are occasionally killed by the foul gases of the cess pools they enter.

Q. Are they subject to any special morbid condition? A. Would death come under that head? They are occasionally killed by the effluvia.

Q. That is the only answer you can give to it? A. Yes, sir.

Q Is it not an accepted maxim that the effluvia from human excrements, unless putrid or tainted with a disease like cholera, never hurt any person? A. I never heard of any maxim relating to it, but I never knew the fresh excrements to do any harm. After a short time they certainly do have that effect. We know that the camps during the war became terribly offensive from the accumulation of that sort of thing.

Q. Is not sulphide of ammonium a recognized constituent of the effluvia from such substances? A. I can only say that I have not paid especial attention to that department of science.

Q. What is the effect of leaving sulphur compounds in gas? A. That depends somewhat on what particular compounds are left in the gas.

Q. Sulphur compounds? A. There are different sulphur compounds; some have one action, some another.

Q. When the gas is burned? A. When combustion takes place they produce sulphurous acid and sulphate of ammonia.

Q. Is that first product of which you speak deleterious to health or not? A. Not in the small quantities which are evolved from the wholly purified gas.

Q. Gas that contains 21 grains? A. No, sir.

Q. Not injurious to health? A. No, sir.

Q. Nor detrimental? A. No, sir.

Q. Or to property? How does it affect property? A. Or to property.

Q. What was the experience in the early days before the lime process was introduced, in regard to the effect of gaslight on health and property? A. The enormous quantity of sulphur in the gas that time, was a source of inconvenience, I believe.

Q. Did'nt it injure property, books, and maps? A. It was claimed that books suffered from it.

Q. Was not its use prohibited in the British Museum? A. I cannot say that it was.

Q. Is there not an especial danger pertaining to sulphurous acid gas, arising from its comparative freedom from odor? A. It is not comparatively free from odor.

Q. You deny the premises? A. I deny the premises. It has, on the contrary, a most suffocating odor.

Q. What is the effect of it upon your eyes, lungs and mouth? A. In a concentrated form it is suffocating, and in the small quantities which gas is liable to put in the atmosphere, it is inappreciable. I have not smelled or peroeived the sulphurous acid, even from the most impure gas that I ever saw burned.

Q. Do chemists hesitate to expose themselves to sulphuretted hydrogen or sulphide of ammonium? A. Not when they are diluted.

Q. Do they hesitate to inhale sulphurous acid? A. Not when it is diluted.

Q. Do you make any distinction between them? A. No, sir.

Q Do they hesitate any more to expose themselves to inhaling sulphurous acid than they do sulphuretted hydrogen or sulphide of ammonium? A. Only in so far as the sulphuretted hydrogen or sulphide of ammonium are more disagreeable when presented in small quantity.

Q. Are they as injurious as the other? A. In minute quantities, I consider that sulphuretted hydrogen and sulphide of ammonium are most injurious.

Q. What is the action of lime on the bisulphide of carbon in the gas? A. I don't know that it has any action.

Q. What is the action of oxyd of iron on it? A. I don't know that it has any action; I answer your question, supposing you to mean at ordinary temperatures.

Q. The Rev Mr. Bowditch says, in his work, on page 27, "At common temperatures hydrate of lime forms with bisulphide of carbon, a very beautiful ruby colored crystalline salt." Do yon agree with the Rev. Mr. Bowditch in that? A. I have never examined the question.

Q You don't know whether he is correct or not there? A. No.

Q. Do you know Brezelius? A. I have read him.

Q. Is he a good authority? A. Yes, sir.

Q. Brezelius says, "By digesting sulphide of calcium with an excess of bisulphide of carbon and water at 30 degrees in a glass vessel, a dark ruby liquid is obtained, and this, when evaporated in vacuo, yields a mass which is yellow, brown and crystalline at first, but assumes a pale yellow color when perfectly dry." Do you agree with Brezelius? A. Yes, sir; I accept whatever Brezelius says, unless I know to the contrary.

Q. If you accept that, does it not necessarily follow that the lime purifier extracts the bisulphide of carbon? A. It doesn't necessarily follow."

Q. Why not? A. In the first place, the conditions were not the same.

Q. If the conditions were the same? A. If the conditions were the same, and there was no other reason for some other change taking place, that might happen.

Q. What conditions are not the same? A. In the first place, Brezelius had an excess of water; he speaks particularly of the excess of water; that might or might not modify the reaction.

Q. I understand you to admit that the Rev. Mr. Bowditch states that at a common temperature hydrate of lime forms with bisulphide of carbon a very beautiful ruby color crystalline salt? A. I accept that substantially.

Q. Now, if you accept that, and if that is true, will not the lime process extract the bisulphide of carbon? A. It will probably extract a portion of it.

Q. Are you aware that the Metropolitan Gas Company scrub their gas copiously with cold water before condensing it. A. I am aware of it.

Q. I want you to say what effect has this scrubbing on the offensive compounds? A. It undoubtedly removes a portion of them.

Q. It carries them off—those at least which are condensible in water, into the tar well? A. A portion of them, not all of them.

Q. That proportion of course is prevented from going into the purifiers at all? A. Yes, sir.

Q. What effect would it have, for example, on the acetylene, in the gas, would it not remove it? A. It would probably remove a portion of it; it don't take all of anything out of the gas.

Q. Does it not take out the tar? A. A portion of it; the greater portion of it. I should qualify that because a very small portion of tar goes to the water at all, it is separated before the scrubbing by water is resorted to, and I suppose it takes out a very small portion of the tar.

Q. Would not the washing with water increase the quantity of tar in the water itself which was extracted? A. The water would extract a little more which would otherwise be left in the gas.

Q. Does not the tar contain all the offensive ingredients of the gas? A. It contains portions of most of them; that is to say the impurities are not all in the tar.

Q. Then this scrubbing process does perform a very sensible office in the purifying of the gas? A. Yes, sir.

Q. And of course, prevents them from going into the purifiers with the waste lime? A. Yes, sir.

Q. Otherwise, if they went into the waste lime there would be more work done there, and that process purifies the gas to that extent at any rate? A. Yes.

Q. The washing process, to a considerable extent? A. Yes, sir.

Q. If you put a woollen cloth or blanket in the atmosphere containing these foul vapors, will it not absorb and contain them for a considerable time? A. I suppose it would.

Q. Is there any doubt about it? A. No, I think not; I think it would.

Q. What are the properties of acetylene as to smell? A. I believe it has a disagreeable odor; but I never smelled it.

Q. Do you know what becomes of it when the gas is burned? A. I suppose it is burred in the gas.

Q. Do you consider Berthelot good authority? A. He is a noted chemist.

Q. Berthelot says that "coal gas is no exception to this general rule—a rule that has been stated—as may be easily ascertained by observing the traces of acetylene which it contains in its normal state. It is produced and discharged into the atmosphere whenever an organic compound burns in contact with the air with the formation of lamp-black." Do you agree with Berthelot in what he says about that? A. I can only say I have often perceived that odor which Berthelot attributes to acetylene, but have no other evidence in the matter.

Q. Berthelot says further as follows: "The same observations are applicable to the composition of coal gas. The gases discharged into the air whether by the flame of a burner known as the bat's-wing, or by the smoky flame of one of Bunsen's burners, contains a notable portion of acetylene." How does that agree with your experience? A. I have perceived the odor from the smoky column of Bunsen's burners, but I have not perceived it from any ordinary gas burner used for illuminating purposes, when not improperly used.

Q. If these statements are correct, would you not object to gas as served, on the ground that it contained acetylene? A. No. I see no reasen for objecting. My wife does not object to the tea kettle apparatus on that account.

Q. Is it not probable that the presence of carbonic acid in the gas might interfere with its complete combustion, and conduce to the formation of acetylene and carbonic oxide and similar offensive or poisonous products? A. Yes, if present in sufficient quantity.

Q. I will ask whether the emanations from the spent lime are injurious to the health of the community in which they are evolved? A. I think they are, because they nauseate.

Q. Is everything which nauseates injurious to the health? A. I think it is, unless a person desires to be nauseated for some other difficulties.

Q. And everything that is nauseating is a nuisance? A. Yes, unless it is resorted to to produce a nausea for a specific object.

Q. Do you mean to say that you have been nauseated by the atmosphere of the purifying house of the Metropolitan Gas Company, for example? A. Well, I am not enough of a medical man to say what nauseating is, but I have been highly disgusted by the smell, and that is what I have understood medical men to understand by the word nauseating. I have not actually been made sick at my stomach, but I have had those impressions which are preliminary to that feeling.

Q. Did you ever know any person that was nauseated—any chemist, by breathing in the laboratory the sulphide of ammonium? A. Nauseated in the sense which I understand it there, I have: the effect that a highly disagreeable odor has upon a person.

Q. Do you mean that these odors which escape from the spent lime are anything more than that you have said is disgusting to you—do you mean that? A. I mean that they are highly disgusting, and what people call nauseating. I am not a physician, and do not pretend to be an expert in medical terms.

Q. You do not mean to say they are detrimental to health? A. I do, because I think it is detrimental to health to be constantly nauseated.

Q. You do not think that there is anything poisonous? A. Anything that produces that disagreeable effect is called a poison, and it is a poison.

Q. Have they the ability to create a disease as a poison does? A. The term poison is so indefinite, I should prefer to say I consider them injurious to health.

Q. Now, I beg you to state why they are injurious to health, in your own language? A. Because they nauseate in the sense I have used the term.

Q. In no other sense? A. Not to my knowledge.

Q. Have they no fermenting properties? A. No.

Q. Most poisons have, have they not? A. No.

Q. How is the odor of roses to you; agreeable or disagreeable? A. In a moderate quantity it is agreeable, though not my pet perfume.

Q. You know that persons are made sick by the smell of roses, even in small quantities? A. Yes.

Q. The same way with regard to the smell of strawberries? A. Yes.

Q. Makes a good many people sick, does it not? A. Yes.

Q. And to others it is delicious? A. So I have understood.

Q. There is no doubt about that? A. I think not.

Q. You would not ask to have them suppressed because they are disagreeable? A. That is so rare.

Q. Have you not heard that there are whole peoples to whom the smell of roses is disgusting and oppressive? A. Never heard of it.

Q. In Italy, for example? A. Never heard of it.

Q. Do you compare these exhalations from the spent lime purifiers with exhalations which are known to be poisonous in minute quantities—like miasmatic exhalations, or those from putrid organic matters? How is that, Doctor? A. I do not compare them with those exhalations which are supposed to be organized, and develop specific diseases.

Q. Are not the latter believed to be of the nature of ferments or organized germs capable of reproduction? A. They are by many persone.

Q. Is mere foulness of odor indicative of poison? A. Poison is an indefinite term.

Q Is mere foulness of odor then indicative of poisonous qualities, or as positively injurious to health? A. I think it is so.

Q Which? A. I think foul odors are, as you say, injurious to health.

Q. As I understand you, you do not compare these exhalations from the lime purifiers, with the exhalations known to be poisonous like miasmatic exhalations, etc, you do not class them in the same category? A. No, sir.

Q. Will you please to state with what known substances or injurious properties, you do compare them in giving them the character you have, which are injurious in excessively minute quantities? A. I compare them with sulphide of ammonium and sulphuretted hydrogen.

Q. I understand you to say, that you never knew in your experience, or heard of any persons who had been killed by breathing one or the other; or that they had ever incurred any disease by breathing it? A. I made that statement.

Q. Do you consider the British Association of Gas Managers a body qualified to consider the subject of the purification of gas? A. Undoubtedly.

Q. In the inaugural address of the president of that body, Thomas Hawksley, Esq., on the 11th June, 1867 Have you seen it, doctor? A. No.

Q. The president says, in that address, in speaking of purification, as follows:

"If there be one thing more injurious than another to the persons by whom gas is consumed, it is the presence of sulphur in any amount in the gas, at the place where it is employed." What do you think about that statement of President Hawksley's? A. I do not think President Hawksley is any more competent to judge upon that point than myself.

Q. He regards the presence of sulphur in any amount as injurious. Do you agree with him? A. I do not agree with that, unless he means the presence of a large quantity. If he means the presence of any sulphur I disagree with him; if of a large quantity, then I agree with him.

Q. I will read to you from this same address of President Hawkesley, as follows:

"I think we shall all be agreed in the desirableness of adopting some means, if such means can be discovered, for the removal of this noxious material. Permit me, then, to mention to you merely as a subject for your consideration; for you all know a great deal about it—that the use of oxyd of iron, which is in itself a very valuable material for the ordinary purification of gas from sulphuretted hydrogen, is insufficient, and a great deal of the obloquy which has fallen upon gas companies during the last few years, has arisen from the adoption of that material, in substitution for the old mode of purification. We all know that lime is very liable to, and in all ordinary cases, does give off an obnoxious smell in the neighborhood; but it, undoubtedly, has this property that, if it creates a smell by reason of its being kept on the gas works, it prevents a much more serious smell in the houses of the consumers, for what you fail to take out of the gas by the oxyd of iron in substitution of the lime, really goes into the dwelling houses, and manufactories, and shops of the consumers, in the form in which I exhibit, combined of course with the gas, but still, in every thousand cubic feet of gas there is a large quantity of sulphur to be burned in the interior of the building where the gas is distributed. Under these circumstances, great attention has been paid to the elucidation of a better chemistry on this subject, and it has been ascertained by Dr. Letheby, as the result of a great number of experiments, made upon a very large scale, a considerable portion of which were conducted in the town—that whereas by the use of oxyd of iron, you cannot remove the whole of the sulphur, but must leave in the gas from 20 to 25 grains in every 100 cubic feet, yet by the use of lime alone, you may reduce that quantity down to less than one half; in fact you may reduce it down to from 10 to 12 grains."

Dow, Dr. Chandler, the question about these extracts is, whether you agree with the president in these statements? A. There are so many statements there—while I agree with some, I do not agree with others.

Q. State what you agree with, and what you do not agree with? A. I agree to the probable effect of lime in removing more sulphur than is removed by the oxyd of iron, but on the other hand, I consider what is said about the effect of these few grains of sulphur, more or less in the gas, to be highly ridiculous and absurd; and am supported in this by the opinion of prominent chemists.

Q. Does that sulphur have the effect to nauseate? A. Not in the maximum quantity which occurs in the gas; it will not have the effect to nauseate.

Q. Do you not know that the British Parliament have passed an act in which it is provided that the gas delivered shall be freed from these small quantities? A. They have passed such an act; and they have passed a great many other ridiculous acts—the "Stamp Act," and several others.

Q. Then you regard the act of the British Parliament as a sanitary measure, in the same light that you do the act of the British Parliament imposing "stamp duties?" A. I do not say it. I say, it does not follow that, because the British Parliament fixes it at twenty grains, that it was necessarily the proper limit. I know that the reason that led them to fix it at that point was insufficient.

Q. You say that, notwithstanding all that you have said, the lime process of purification is the process which is in use in all the large cities of the United States? A. Yes.

Q. Including the city of Philadelphia, the gas for which is manufactured and purified by the municipal corporation itself? A. Yes.

Q. Where does the purification of gas by the iron process prevail? A. In all the large cities of Europe.

Q Are you not aware that in communities where this process of purification by iron has been adopted, that it has proved to be a failure, and that the companies that have adopted it, are, in many instances abandoning it, and are returning to the lime process of purification. Have you not been so advised? A. I have been advised that the iron process is still in use on the continent of Europe; but that, owing to this foolish law of the British Parliament, the gas companies have been so hampered—the iron process not allowing them to keep within the act—I have heard that on that account, they would return to the lime process.

Q. As a process which would enable them to deliver gas of the purity required by the act of the British Parliament? A. Yes.

Q. And will you not say as an expert, that the lime process does deliver a purer gas to the consumer than the process of the oxyd of iron? A. I think it does.

Re-direct examination of Prof. Chandler was deferred.

Prof. Benjamin Silliman, Jr., called for the Metropolitan Gas Light Co., being duly sworn, testified as follows:

By Judge Van Vorst.

Q. State, if you please, your profession? A. I am a chemist, residing at New Haven, and have charge of the department of general and applied chemistry in the Academical Department of Yale College. I have been connected with the institution since 1847, as a professor, and since 1838, as a teacher.

Q. Have you given particular attention to the subject of the manufacture of coal gas? A. I have been practically familiar with the manufacture of coal gas for about twenty years.

Q. Have you studied the subject of its purification? A. I have.

Q. And have observed it practically? A. I have observed it practically.

Q. What is the method of purification in the United States, as far as your knowledge and experience goes in that subject? A. The usual method of purification of gas in the United States is what is familiarly known as the dry lime process, in which the hydrate of lime is employed; and there is in use in a few companies, what is known usually as the wet process, in which the gas is first passed through a salt of iron, green vitriol, and then through milk of lime under pressure, under weight of machinery. I might further answer your question by saying that, so far as I know, there is but one company in the United States that employs the iron process, which is the usual process in Great Britain and on the continent of Europe.

Q. What is the company you speak of? A. I think it is called the New York Gas Light Company. It is the old company. I visited their works last summer.

Q. You have visited the Philadelphia companies works? A. I have visited the Philadelphia companies several times.

Q. You have witnessed their processes? Yes, sir. I have been familiar with several gasworks, particularly Boston, Worcester, Hartford, New Haven and Louisville.

Q. Have you been in Prof. Smith's establishment at Louisville? A. I have, recently.

Q. Since his return from the World's Fair? A. It was about the first or second week in September I was there. He uses the dry lime process.

Q. You have witnessed the purification of the New York works. What, in your opinion, is the best mode of purification of gas? A. I have no hesitation in saying that, if properly conducted, the dry lime process offers by far the best means of purification.

Q. Why? A. For several reasons, first, because it does effectually remove all the sulphur which is in a state of chemical combination, such as is capable of being removed on a large scale by any known process. I might make an exception of Dr. Bowditch's method. I know nothing about his method practically. I except, of course, in this generalization, the sulphur combined in such forms as to escape the ordinary tests employed to indicate its presence. This process does effectually remove the carbonic acid, which no other known process does remove.

Q. Any other reason, Professor? A. I do not think of any other, As regards ammonia, I do not know that it is more efficacious than other processes, and believe it is less efficacious than the process of wet lime with the salt of iron, which does remove all the ammonia.

Q. The most deleterious substance or element to which your attention is directed in purifying the gas—does it not seem to be sulphur? A. Yes, sir. In its various forms of combinations, it is the black beast of the coal gas manufacturer.

Q And which you seek to eliminate? A. And which we seek to eliminate. You will observe I made an important distinction. I said if applied with suitable precaution.

Q. It more effectually removes the sulphur? A. More effectually remove the sulphur than any other available process.

Q. What objection, if any, exists to the dry lime process? A. The objections to the dry lime process are two-fold; first, that the material is exhausted, and, to a great extent, lost in respect to its value in the art of purification, and that no process has yet been discovered by which it can be restored to a condition to purify gas again. That is a loss which falls upon the company.

Q. Anything else? A. Second—that this accumulation as an effete waste product about the gasworks, as ordinarily conducted, constitutes a just ground of complaint as a nuisance, using the term nuisance in the sense of that which is offensive.

Q. Offensive to the smell? A. Yes, sir. I classify nuisances under two general heads—those which are offensive to the sense of smell, and as such repulsive to our sense of taste; others which are deleterious and noxious as regards health. In the first class I would arrange gas works and stables among causes of that kind; and in the second I would place all such nuisances as bone boiling establishments and glue establishments, and others where putrescent animal matter is the subject of treatment; which are decidedly and confessedly injurious to public health.

Q. You do not consider the emanations from the gas works of which you have spoken, as deleterious to health? A. Long familiarity with the management of the New Haven Company, with which I have been associated as a director has satisfied me, that no injury to health—no bodily injury attaches to the use of dry lime. By diligent inquiries, the only complaint I have heard was, some irritation of the eyes of the persons about the boxes, when they are opened. That proceeds from the ammonia and is entirely transitory. On the contrary, parties living in the immediate vicinity of these works, have always asserted that they have enjoyed excellent health.

Q Then you do not regard those exhalations or emanations as deleterious to health? A. I do not. I should like to distinguish, however, between the classes of emanations which are given off in the decomposition of effete lime. I would call your attention to what seems to me an important distinction that exists between two quite distinct groups of exhalations, viz., that the first effect of the atmospheric air upon the effete mass, is an effect of oxydation, resulting in a state of high temperature, the whole mass of the effete lime becoming so hot that you cannot conveniently bear your hand in it, and this process of oxidation accompanied by the production of watery vapor and free ammonia, which exercises a stimulant effect, such as is due to this active agent; and second, an entirely distinct class of effects is that which arises from the gradual separation at a later stage of the process, of highly offensive hydrocarbons, probably containing sulphur as one of their constituents, and characterized by an extremely persistent odor. This latter class of odors I have observed is not developed in the earlier stages of the decomposition of the mass. There is always to be perceived during the process of oxydation, as alluded to, the odor of sulphuretted hydrogen escaping from the decomposition or combustion of the sulphide of ammonium; but this odor of sulphuretted hydrogen or sulphide of ammonium, is restricted to a radius of limited extent—measuring from the purifying box as a starting point, and soon disappears. There, sir, is a sample of lead paper, prepared this morning, in the yard of

the Metropolitan Gas Company, by exposing the paper, when moist, to the atmosphere of the yard, at a measured distance of 40 feet from the building, and in close proximity to one of telescopic holders of the yard. Here is another lead paper, prepared in precisely the same manner, which was exposed at a distance of 60 feet from the windows of the purifying houses, the wind blowing from the direction of the house strong over the paper. Here is another paper of precisely the same kind, which was exposed at the measured distance of 70 feet from the same point. All these measurements were taken from the same point; and here is a fourth, at a distance of 75 feet northeast. I think you will perceive distinctly, a diminution of the intensity of the action of these sulphur compounds with this moderate increase of distance. The last is very slight —scarcely perceptible.

Q. At a distance of seventy-five feet from the works, the wind blowing from the purifving house, it scarcely discolored? A. It scarcely discolored the lead papers. I should remark, that these lead papers were all exposed in a moist state, and remained there exposed until they had dried off in the wind, which was about 15 or 20 minutes.

Q. You mean that the sulphide of ammonium evolved from the lime was so diffused at that distance that it made a very slight impression upon the paper. A. Yes, sir. Another very characteristic odor of the effete lime—spent lime—is that which is attributable to naphthaline—a substance which is always found to to a greater or less extent in connection with spent lime, and which develops itself frequently in the latter stages of the decomposition—some weeks even after the material has been exposed to the action of the air. This beautiful pearly and micaceous substance appears in brilliant crystalline plates, lining the cavities or covering the surface upon the spent lime and its odor is, likewise, clearly perceived at an early stage, when the box is first opened. The odor of naphthaline is agreeable to me. It is employed in small quantities as a perfume. I will exhibit some samples I picked out of a heap this morning from the pile of spent lime which had been exposed some three weeks. You will see, that it is perfectly filled with those beautiful scales of naphthaline.

Q. You were there at the Metropolitan works when the purifiers were opened? A. I was.

Q. This morning? A. Yes, sir. They had one opened specially for our inspection, and which had been running, I was informed, 41 hours prior to the time when we saw it opened; and that there had passed in that time, by the registration of the station meter, one million feet of gas.

Q. What was the state of the atmosphere there this morning, when you were there? A. The outer atmosphere was bright, and clear, and cold. The atmosphere of the room, before the box was opened was not disagreeable; and when it was opened, there was an odor of napthaline, and for some little time, I could perceive nothing else. Very soon, however, the powerful action of oxydation set in, and the lime began to give off vapor of rather a strong odor of ammonia, overpowering every thing else.

Q. Is ammonia deleterious to health? A. It is estimated the reverse.

Q It is a stimulant? A. Yes, sir. Administered to revive fainting persons.

Q. Was there any sulphide of ammonium present? A. Undoubtedly.

Q. How much? A. It is impossible to form any more than an empirical judgment as to that. The nose is a poor analyst. Undoubtedly there is a large quantity of sulphide of ammonium.

Q. In this connection, now, I will ask you, what are The objections to the iron proces of purification? A. the principal objection as I conceive to the iron process, is, that it is less efficacious in general, as a means of purification than lime. It does so efficaciously remove the free sulphur. It does not effectually remove the carbonic acid. It does not effectually remove the ammonia.

Q. It does not effectually remove the phenol? A. That I cannot speak of from my personal knowledge.

Q. State the objections to the process? A. There is this principal objection; I conceive that in every metropolitan gas works, it is the bounden duty of the company to exercise all possible diligence to avoid the nuisances which are sure to manifest themselves, whatever agents may be employed for purifying, and for this purpose, there is no means hitherto discovered, that appears to be so efficacious as the method of ventilation, which has been recently adopted by the Manhattan works in this town, and this process of ventilation appears to be inapplicable to the iron process for the important reason, as it appears from the writings of Mr. Clegg and other English authorities, that the heat generated by the active chemical efficiency of the oxygen, is created in such an amount as to heat the mass to redness and set fire to the wooden screens and destroy the apparatus, while in the case of spent lime, ventilation restores it to a condition inoffensive to health, and leaving a product which, as I conceive, has high value for agricultural purposes. I shall present a specimen of spent lime which I took from one of the boxes of the Manhattan works, which represents fairly the mass of the material as it exists in the boxes. There is a feeble odor slightly of ammonia and slightly of gas tar, but it is not an offensive material. I speak of it in a large way. It consists chiefly of sulphate and sulphate of lime, with some free lime, called hydrate of lime, and is, therefore, a mixture which the agriculturists may employ with great advantage as a fertilizer, which is not true of the spent lime—of the dry lime process, as it is ordinarily sold by gas companies for such uses.

Q. What odors does the effete iron give forth after it has purified the gas! A. My recollections of the visit which I paid to the New York Company last June or July are not very distinct; but my recollections are that the mass smelled of ammonia, and that there was, also, to some extent the usual familiar odor of the gas house, but decidedly to a less extent than in case of the lime purification.

Q. Were they nauseating or disgusting in their character—did they have that tendency? A. I could not say that they had; at the same time I ought to state, in that connection, that my attention was not so much directed to any question of the sanitary effect as to the economic one as affected by the iron process in place of the lime process. I went there expresely as a director of the New Haven Company—in that point of view.

Q. You concluded not to adopt it? A. Concluded not to adopt it. I was not satisfied with the degree of purffication.

Q. Do I understand you to say that the oxide of iron fails to eliminate the sulphur in the various forms in which it exists in the gas? A. Not in so broad terms. I say that, it fails to eliminate it to the same extent as lime does.

Q. Have you observed, since you have been in New York, the gas delivered by the Metropolitan Gas Co? A. I have this morning and measured it with the photometer. I also tested it with lead paper to determine the presence or absence of free sulphur compounds, and found none.

Q. Is there not, as yet, much obscurity in the minds of chemists generally, about the complete nature of the action of the lime—the complete composition of the waste and the effluvia therefrom? A. I do not know of any thorough chemical research upon the whole subject of purification of gas; and certainly think there are many important questions connected therewith, that need further examination.

Q. In a sanitary point of view, do you think the purification by the oxide of iron, has any advantages over the lime process of purification? A. Not if the lime process is conducted with suitable precaution; on the contrary, I conceive that in the aggregate, the annoyance and injury to property which results from impure gas.

Q. I am speaking in a sanitary point of view. A. It affects the health. The respiration of air in a close room affects the eyes and the organs of respiration by reason of the presence of sulphurous acid or sulphate of ammonia, or both, which may be present, is given out in the process of combustion, and which ought to be removed, in great measure, in the purifying house

Q. In a sanitary point of view, comparing these two processes of the purification, and the quality of gas delivered by them respectively, do you not give the preference to the lime process of purification over that of iron? A. With the same explanation as before—that the lime process, conducted in a proper manner, I think is capable of producing the best results for the public good.

Q. State, if you please, what is your own personal experience in regard to the burning of gas charged with sulphur, in a close room? A. I have often observed that, upon placing my head in an elevated position, as upon a step ladder or any other means of reaching the upper portion of the room where numerour gas lights were burning, there was a very decided irritation to the organs of respiration, and to the eyes; and resulting as I conceive (and know in fact,) from the production of ammoniacal salts and of sulphurous acid. I find ammonia to be a much more frequently occurring impurity in gas, than most writers report.

Q. Is not sulphide of ammonium a very unstable, perishable and transient substance in the air? A. I have reason to suppose that sulphide of ammonium is rapidly oxidized by the action of the atmosphere with the production of free sulphur and water, of course.

Q. Is not sulphuretted hydrogen quickly destroyed by the air? A. It is. I have observed that, in visiting the natural sources of sulphuretted hydrogen; such as the famous baths in the neighborhood of Rome, and other lakes and springs, that the odor of sulphuretted hydrogen does not penetrate, nor is it carried to any great distance from the springs.

Q. Is there any sulphuretted hydrogen concerned in this case at all? A. No, sir; I cannot conceive of the existence of sulphuretted hydrogen, as such, in a free state, in presence of an atmosphere so highly charged with free ammonia, as we find that to be where a dry lime purifier is freshly opened, and the process of atmospheric oxydation has set in. I might add in that connection, the sulphur compound which affects the lead paper I conceive to be, generally, if not exclusively, sulphide of ammonium. This lead paper is the only guide which the gas maker employs to determine when the gas is sufficiently purified to be sent to the consumer, purified from the sulphur, of course.

Q Did you ever know or hear of an employé or visitor in any gas-works being killed by the effluvia of the fouled purifiers, or injured thereby? A. Never.

Q, What is the state of health of those persons who are concerned in and about your purifying house, in the New Haven works and other places? A. I think I have answered that question. I should say in general that I have always made diligent inquiries wherever I have been, about the health of the persons employed about the purifying houses, and the answer has always been, that their health was excellent.

Q. You do not know that they are subject to any particular diseases? A. No, sir. There is a prevalent opinion, which may be worthy of record, that in times of epidemic diseases, such a cholera and yellow fever, they do not prevail in the vicinity of gas-houses. I heard that opinion expressed very confidently in New Orleans twenty years ago, where the yellow fever is very prevalent.

Q. What do you attribute that to? A. I conceive it must be attributable to the specific medical effect of some of the products of the distillation of coal, of which I would name carbolic acid, which is the same thing as phenol, as the most perfect representative of that class of agents which are most destructive to the spores and germs of fermentation of fungoid growth to which some physicians, with some confidence, attribute epidemic diseases.

Q. Has the presence of sulphur anything to do with it? A. Sulphurous acid is well known to act in the same manner as an efficient agent in the destruction of germs and spores which produce ferment and disease, and sulphur itself, as such, is largely employed for the destruction of mildew. I do not know that sulphur or sulphurous acid either, in this case of gasworks, has any application.

Q. Are the emanations or exhalations from the spent lime, when the purifiers are opened, poisonous or deleterious to health? A. I should say, decidedly not deleterious to health—that would open the question of what you mean by poison.

Q. Deleterious to health? A. I think a man would speedily be killed in an atmosphere of pure ammonia.

Q. Whether the process of manufacture of gas by the Metropolitan Gas Company, as you have observed it, gives forth any deleterious gas or odor detrimental to health? A. No.

Q. How would you compare those exhalations or emanations from organic substances which produce those disagreeable odors which you speak of as from bone-boiling houses? A. I can say that, in all cases where putrescent animal matters are undergoing transformation, there are emanations which may be, and in many cases probably are, decidedly detrimental to public health. It is well known that those emanations excite putrescence in other substances, causing milk to pass rapidly into acetous and putrefactive fermentations. I have no doubt that a carcass, as of a sheep, hung up in the purifying-house of a gasworks, would escape putrefaction very much longer than when hung within a short distance of one of those sources of animal contamination, or even a tenement house. It is well known to chemists that animal substances are prevented from passing into a state of decay by being simply exposed to gaseous exhalations of gas possessing antiseptic properties, such as sulphurous acid and phenol, and carbonic oxyd. It is well known that meats or dead bodies washed with phenol escape for a long time the action of putrescence, and for the same reason coal-tar is an antiseptic, because it contains several of these substances.

Q. I ask you this: whether you observed, in the neighborhood of the Metropolitan gasworks any causes which would be likely to produce these contaminating or deleterious odors of which you speak? A. When I went down 42nd street this morning before I reached the works, the wind blowing strong from the water towards me, I perceived very decidedly the odor of decomposed animal matter. The familiar odor of bone-boiling or fat houses, or piggeries, or all combined. I did not know what source it came from, but I called the attention of my companion to the fact that there was a stench which many persons in their ignorance might attribute to the gas-house, which was not far off, but I was very particular to remark, that it was clearly attributable to some cause to me unknown like the house or manufactory alluded to. I was informed that there were, in that direction, below me, places of that kind—I believe a piggery or bone-boiling place, but I did not visit them.

Q. How soon after reaching 42nd street did you notice these odors? A. After I left Tenth avenue, I noticed it before we had passed one hundred feet. It evidently proceeded from the direction of the wind, which was blowing out of the southwest at that time.

Q. And had its origin in decomposing or decomposed animal substance? A It so addressed itself to my senses.

Q And it had none of the properties peculiar to gas or its manufacture? A. None whatever.

Q. And those you would say were detrimental to health? A. Such I conceive to be detrimental to health.

Adjourned to Saturday, Feb 13th, at 10 o'clock.